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"THE RAILWAY MECHANICAL MONTHLY"

(Including the Railway Age Gazette "Shop Edition.")

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CONTENTS

Study Foreign Practice

Experience in the past has shown that there are many features of locomotive and car design and arrangement in common use on foreign railways which can be adapted to American conditions with great advantage. The Walschaert valve gear and the superheater are prominent recent examples. While we have looked on the French and German railways as being the source of the most advanced practice, the English and Scottish roads should by no means be overlooked. This is indicated by some of the minor details on the Caledonian Railway of Scotland described by Mr. Hodgins in an article on another page.

Our General News Section

With the widening of the scope of the work of the *American Engineer* it has seemed wise to enlarge the field covered by the news items and to include them in a section by themselves. While the General News Section in this first issue of the new *American Engineer* is not perfect, and falls far short of the ideals of its editors, still it gives a fair idea of what we are trying to accomplish. To make it a real success we shall need the hearty co-operation of our readers. We shall greatly appreciate prompt advice as to all changes or promotions in the motive power department and for items of interest concerning new shops and engine houses, or for information concerning the addition to or rebuilding of old shops or repair plants. Also for any other items which may be included in the news department.

Another Shop Kink Competition

A shop kink competition will be held, to close March 15, 1912. A first prize of $50 will be awarded for the best collection of three kinks, and a second prize of $25 will be given for the next best collection. Any kinks or labor saving devices used in the maintenance of equipment in the mechanical department will be eligible. Each kink should be clearly described, both as to its construction and operation. In most cases it will be necessary to use illustrations in order to bring out these points properly, and these illustrations may consist of either blueprints, drawings, pencil sketches or photographs. More than three kinks may be submitted in a collection, allowing the judges to base their decision on what they consider to be the best three in each collection. The kinks need not necessarily have been devised by the party who submits the descriptions, but, as far as possible, the name of the parties responsible for their design should be mentioned. Kinks not awarded a prize, but accepted for publication will be paid for at our regular rates.

Locomotives Need More Lungs.

A locomotive designer when asked concerning the future of the high speed, heavy passenger locomotive said: "The present types are satisfactory, if they had more 'lungs.'" More lungs, however, means more weight, and the limitations of axle loads make it impossible to go very far with mere size. Believing, however, that the possibilities of the Pacific type locomotive had not yet been exhausted, the American Locomotive Company has at its own expense designed and built a locomotive for the purpose of obtaining information as to the exact possibilities in this direction. It desired to see what could be done toward obtaining a maximum power per unit of weight with conservative axle loads, and has built No. 50,000 with an average of 57,500 lbs. per pair of drivers. The object throughout was by the use of the most careful designing and of the very best materials to reduce the weights of the running gear so far as possible and use the weight thus saved in the boiler. Then, by the application of a knowledge gained by a long experience, to proportion the boiler to give the greatest output and to use approved fuel saving devices as far as practicable. This locomotive has been in service for some time, and has

clearly demonstrated its superiority for high speed work over all other Pacific types. It has developed an indicated horse power for each 121.4 lbs. of total weight, which probably stands as a record, in this country at least. Even in this short time the effect of the service of this locomotive is noticeable in the latest designs being built for the various railways, and the American Locomotive Company is to be commended for its aggressive and broad minded action.

Competition on Reclaiming Scrap Material

A competition on this subject, held last summer, brought out some splendid papers, but the subject is such a big and important one that much still remains to be said, and so we have announced another competition on the same subject to close February 15, 1912. A prize of $35 will be awarded for the best paper on the subject, and a prize of $20 for the second best. Tell us clearly just how you have gained results in reclaiming scrap or second-hand material, and what the net results were. Can the work of reclaiming scrap be carried too far? Are the services of an efficiency engineer necessary in order to know where to begin and when to stop? Will it do any good to educate the men to realize the value of the materials which they work with, and how can it best be done? There are a hundred different ways in which the subject may be treated. Articles not awarded a prize, but accepted for publication will be paid for at our regular space rates.

Reducing Engine Failures

It is suggested by Mr. Cordeal in his paper on this subject, page 23, that investigation of the causes of each engine failure should be continued until the blame is placed directly on the shoulders of some person or persons, either the builders, the designer, the train despatcher, engine house foreman, engineer, workman, or whoever may be at fault. In this way it is believed, by means of the proper publicity given to the reports that all concerned will be more careful to avoid any possibility of the blame resting on them, and also that the tabulating of information obtained from these investigations will permit a quicker and more accurate correction of parts poorly designed or built of poor material. Mr. Cordeal's ideas are based on principles which have worked very successfully in other lines, and there would seem to be no reason why they should not be equally valuable in connection with this very important feature.

Shop Kink Prize Winners.

Ninety-three shop kinks were submitted in the competition which closed September 15, 1911. Ordinarily the prize winners are announced in the first issue following the close of the competition. In this instance the judges were unable to report sooner. The first prize of $50 has been awarded to R. E. Dette, foreman of the South Pittsburgh machine shop of the Pennsylvania Railroad, at Pittsburgh, Pa. The second prize of $25 was awarded to H. L. Burrhus, assistant to the general foreman of the Erie Railroad, Susquehanna, Pa. The other competitors, many of whose contributions were in the prize winning class, and all of which have been accepted for publication, were C. L. Dickert, assistant master mechanic, Central of Georgia, Macon, Ga.; C. J. Drury, master mechanic, Eastern Railway of New Mexico and the Southern Kansas Railway Company of Texas, Amarillo, Tex.; W. T. Gale, shop demonstrator, Chicago & North Western, Chicago, Ill.; J. A. Jesson, air brake foreman, Louisville & Nashville, Corbin, Ky.; C. C. Leech, foreman, Pennsylvania Railroad, Buffalo, N. Y.; Walter B. Lyons, apprentice instructor, Atchison, Topeka & Santa Fe, Topeka, Kans.; E. T. Spidy, assistant general foreman, Canadian Pacific, West Toronto, Can.; M. H. Westbrook, Battle Creek, Mich. and W. H. Wolfgang, Toledo, O.

Superheaters Prove Economical

Reports of service tests of locomotives, equipped with the high degree superheaters of the Schmidt type, have been universally very favorable as concerns the saving of coal and water, which is only another way of saying increased capacity of the locomotives. On the Chicago & North Western the service of the passenger engines fitted with Schmidt superheaters has proved very satisfactory and freight locomotives are now being so equipped at the rate of about 40 per month. A test was made last spring on two superheater freight engines of the consolidation type, comparison being made with two of the same class engines without the superheater. The boiler pressure in both cases was 170 lbs., the cylinders measured 25 in. x 32 in., the driving wheels 69 in. in diameter and the non-superheater engines had 436 2-in. flues and a total heating surface of 2,657 sq. ft. The superheater engines had 261 2-in. flues and 36 5⅜-in. flues, giving an evaporative heating surface of 3,629 sq. ft., and a superheating surface of 610 sq. ft.

The tests were made on the Iowa division between Belle Plaine, Iowa, and Boone, a distance of about 85 miles. A dynamometer car was used, but the locomotive was not indicated and all figures for horse power are on the basis of the dynamometer car records. The average for the superheater engines against the non-superheater gave a saving of 27.51 per cent. in coal per horse power hour in one direction and 23.78 per cent. in the opposite direction. The water saving was somewhat larger, being 31.19 per cent. and 30.30 per cent., respectively.

Careful examination of the data of these tests indicates that these figures are probably too high, owing to the fact that in both cases the non-superheater engines were longer on the side track and as the coal wasted in this way was not subtracted from the total amount, it gives them slightly too high figures in these particulars. On equal time basis, the tests indicate that the ton-miles per ton of coal were increased somewhat over 20 per cent. on the superheater engines.

This result checks very well with other tests that have been published, where the non-superheater engine was being worked within its capacity. In cases where the comparison is made between the heaviest load the saturated steam and the superheated engines will handle over the road without stalling, the full advantage of the superheater is much more evident, as one of its most prominent characteristics is a continually increasing efficiency as greater demands are made upon it.

Railway Shop Floors

There appears to be almost as much difficulty in obtaining a satisfactory floor for railway shops as there is in making a roadway covering which will resist the wear of automobile traffic. There is such a degree of similarity in the requirements for the surface of shop floors and roadways that something may be learned from experience in road building which may be profitably applied to floor construction. The necessity for further investigation is seen in the failure of the floors in two large new erecting shops where maple covering has been used and where no expense was spared to secure a permanent and satisfactory floor. The mistake has been made in treating the whole locomotive shop as a unit and in using wooden flooring in all departments.

While maple flooring may answer for dry shops where there is slight abrasion and little warping, it has failed completely in the erecting shops where the surface is frequently wet from boiler testing and is subject to considerable wear from the rough handling of heavy castings. The thin boards have warped so badly that they have split and broken, creating a surface which is the very opposite of what a good floor should be. It takes but a short time for a thin wood floor covering of the best material to be badly injured by moisture. In one of the shops referred to the floor has been laid less than a year and now requires repairs or replacement; in the other not only has the

surface failed, but the bedded timber, to which the maple flooring was nailed, has decayed in 4 years so that there is no solid foundation on which to build up a new floor. These timbers may fail from dry rot even where there is little or no surface moisture. When laid on cinder they settle so that the surface is not level, and when bedded in concrete they shrink, leaving an air space, and the floor is not then fireproof. If a wood floor is used in a dry shop the supporting timbers should be treated to prevent decay and the foundation should be concrete. While such a floor may answer for light machinery and where there is little wear, it cannot be regarded as satisfactory for the rough service of a locomotive shop.

In the search for a better material concrete has been recommended, as it has the advantages of being fire and water proof, it will not decay and the general surface is well maintained, but with this also a special surface is required where the heaviest work is done. The advantages and disadvantages of concrete floors for machine shops were considered in a paper on Factory Construction by L. P. Alford, which was published in the *Journal of the American Society of Mechanical Engineers,* October, 1911. The paper states that in those sections containing the largest machine tools and receiving the heaviest castings the concrete floor should have a special surface by adding 1½ in. of a 1 to 2 granolithic mixture. The first cost of the granolithic floor surface is about the same as that of the ⅞-in. maple flooring, but in order to make it sufficiently durable to resist the rough usage of the machine shop it must be made of hard material with a high percentage of tough elastic aggregate, so that the wear due to trucking is borne almost exclusively by the aggregate itself. The finish need not be over ¾ in. thick, but it is important that the granolithic surface should be laid on the floor slab while the latter is still green, a condition difficult to obtain in railway shop construction.

While a hard concrete floor is desirable to resist wear, it is objectionable on account of the damage to machine parts and hand tools which may drop on it, and the floor itself is also likely to be damaged in this way. It also crumbles at the edges of cracks and wears holes where there are soft spots subjected to heavy pressure. Repairs in such places have been made by avoiding the use of cement and substituting an asphaltum mixture which is applied to the surface in a plastic condition and is then bonded to the concrete by heating with a gasolene blow torch. Another objection to the concrete floor is its apparent coldness—most railway shop floors are in contact with the ground. As concrete is a better conductor of heat than wood a cold concrete floor will withdraw bodily heat from the feet of the workmen, but if the shop is well heated the floor will become nearly as warm as the surrounding air, and for workmen who move about at their work there should be little objection to concrete on this account. Where the men stand in one place at machine tools it is desirable to provide a small wood platform for their comfort. In a recently built locomotive shop a cement concrete floor is used for the tank shop, and the car truck shop is furnished with diamond steel plates ⅜-in. thick laid on the concrete and held by countersunk bolts with expanding nuts embedded in the concrete.

While the concrete and granolithic surface will be found satisfactory for the machine shop it is not suitable for the erecting shop, where its waterproof qualities should recommend it, the principal objection being that it disintegrates by the rough handling of heavy castings and forgings, and it injures the finished machinery and hand tools which fall on it. It is possible that a concrete made of fine, hard stone with an asphalt binder could be used for the surface finish of the floors of erecting shops and engine houses, and would have sufficient hardness to resist wear and would also possess the slight elastic quality which would overcome the objectionable injury to machinery and tools above referred to.

The experience in making roads for automobile traffic should help in solving this problem. As we have shown that the thin maple flooring and the concrete with cement surface are not satisfactory for erecting shop floors, there remains another kind of roadway material which appears to have the desirable qualities, and that is the creosoted wooden block laid on end. If these blocks are laid on a good concrete foundation and thoroughly waterproofed they should meet all requirements. We believe that creosoted wood blocks have not been used heretofore for shop floors, and their use is recommended especially for engine houses and erecting shops where a waterproof and yielding floor is required and where most other materials have failed. It is true that wood blocks have been used for shop floors and when kept dry have been satisfactory, but when the floor is wet the wood swells, and the surface is bulged or the tracks are forced out of gage. A wood block floor properly waterproofed would not act in this way, as is demonstrated by its action when used as street paving. Here the blocks are constantly exposed to rain and extremes of heat and cold, but the surface remains smooth.

While thin wood floors may answer well for dry shops and concrete for wet ones, where they are exposed to light loads and slight abrasion, they are not suited to the unusual requirements of engine houses and erecting shops; for such places creosoted wood blocks laid on end may be recommended as the best material.

The American Engineer

While the first locomotive to be operated on rails in this country was imported from England in 1829, because of the fact that it was not successful, it is believed that the credit for the first locomotive in the country should be given to Peter Cooper's "Tom Thumb," which was successfully operated on the Baltimore & Ohio in August, 1830. About 15 months later the first railway paper in history—*The American Railroad Journal*—made its appearance, being published by D. K. Minor at 35 Wall street, New York. Although the first issue bore the date of January 2, 1831, it was evident from the future issues of the same volume that this was a typographical error and should have been January 2, 1832. This journal antidated its nearest contemporary in the same field by at least 3 years.

It is stated by the publisher in the first issue that "the principle object in offering the proposed work to the public is to diffuse a more general knowledge of this important mode of internal communication which at this time appears to engage the attention of almost every section of our country." The paper was published weekly, and in addition to the articles on railways, it also contained considerable literary, miscellaneous and news matter. A notice of a locomotive built by Bursom & Co., of Philadelphia, appeared in the first issue, and it was stated that this locomotive, "is as simple as a common cart or wheelbarrow," and "works complete and justifies the belief that it will outrun the far famed 'Rocket' and 'Novelty.'"

The heading of the first edition was an illustration of the Novelty attached to a carriage for passengers of a size to accommodate 18 persons inside. This heading was changed the next year and in the third year it was again changed, showing a view of the "Philadelphia," built at the West Point Foundry Works for the Philadelphia, Norristown and Germantown Railway. It was shown attached to a freight car, a passenger coach and a flat car carrying a private carriage, which it is stated, "indicates the advantages and facilities that may be enjoyed by the inhabitants living in the vicinity of railroads."

At the start, each number contained 16 pages, and during the first two years it had a fairly prosperous appearance, but in 1834 it was announced that it was not paying expenses, and in 1835 it was stated that a larger number of patrons must be obtained. It apparently existed in some manner until 1837, when Mr. Minor associated himself with George C. Schaeffer. In August

of that year, however, publication was suspended, and the September and subsequent numbers did not appear. In July, 1838, it was revived, the *Mechanic's Magazine* being combined with it, and the title was changed to *American Railroad Journal and Mechanic's Magazine*. In June, 1839, Mr. Minor disposed of his interest to Egbert Hedge. In 1843, however, he apparently again became interested in it, as his name appears on the title page, with that of Mr. Schaeffer, as one of the editors and proprietors. In November, 1844, it was announced that on the first of January, 1845, the journal would again be issued in its original form of 16 pages, which has apparently been reduced. It was also stated that when the journal was first started "the details of construction occupied the prominent place, whereas now the management of railways, their cost, income and dividends will especially receive our attention."

In November, 1846, the office of the publication was moved to Philadelphia, but in January, 1849, it was again returned to New York, and Mr. Minor disposed of his interest in it to Henry V. Poor, who was its editor until 1862. In 1849 the name of John H. Schultz and Co. appears on the title page as publishers. Mr. Schultz retained an interest in the paper until 1882, and then another company was organized to publish it with George F. Swain as president. From that date it was conducted by a number of different editors until October 1, 1886, when it was purchased by N. M. Forney, whose name appears on the title page as editor and publisher. In January, 1887, it was consolidated with *Van Nostrand's Engineering Magazine* under the title of the *Railroad and Engineering Journal*, Mr. Forney being the sole proprietor.

On January 1, 1893, the name was changed to the *American Engineer and Railroad Journal*, and the title page contains the names of N. M. Forney as proprietor and editor, Frederick Hobart as associate editor, and Frank J. French as business manager. It was stated in this issue that Mr. Chanute's articles on the progress of flying machines would be continued and concluded in that volume.

Another change in ownership took place on January 1, 1896, when Mr. Forney disposed of his interests to R. M. Van Arsdale, who for a number of years previous had published the *National Car and Locomotive Builder*. The two papers were consolidated under the title of the *American Engineer, Car Builder and Railroad Journal*, Mr. Forney continuing as editor, and Waldo H. Marshall became associate editor. George H. Baker, who had been editor of the *National Car and Locomotive Builder* for the four years previous, retired at this time. For the first six months of 1896 it was published on the 9½ x 14 in. type page of the *National Car and Locomotive Builder*, but in June it was changed to its previous and present standard size.

Mr. Van Arsdale continued as its proprietor up to the time of his death, November 23, 1909. He shortened the name to its previous form—*American Engineer and Railroad Journal*—on June 1, 1899. On June 1, 1897, Mr. Forney retired from active service and Mr. Marshall resigned to take the appointment of assistant superintendent of machinery, Chicago & North Western Railway. G. M. Basford, who at that time was an editor on the *Railway Review* at Chicago, became editor. Mr. Basford remained as editor until October, 1905, when he was succeeded by R. V. Wright, who continued in charge of the editorial department until March, 1910. On Mr. Van Arsdale's death, the publication was continued by R. M. Van Arsdale, Inc., of which Mrs. Van Arsdale was president and J. S. Bonsall, who for the previous 12 years had been business manager, was vice-president and general manager.

With this issue a new era is begun. As was announced in the December number, the property has been purchased by the publisher of the *Railway Age Gazette*, and the *American Engineer* will now include the matter which has previously appeared once each month as the Shop Section of the *Railway Age Gezette*, in addition to its usual articles on other activities of the mechanical or motive power department.

The Shop Edition of the *Railway Age Gazette* was started October 1, 1909. That number contained part of the results of the first shop kink competition, which had been announced in the issue of August 27. The idea met with so much appreciation that the scope of the work was gradually extended, and a few months later all of the mechanical material in the first issue of the month was grouped together in a section of the paper, known as the Shop Section.

The work of this department increased in importance to such an extent that it was decided by the publisher of the *Railway Age Gazette* to purchase the *American Engineer & Railroad Journal* and combine it with the Shop Section. Hence the following annuoncement in the December, 1911, Shop Section: "The reason for this change is that our work in the interests of shop efficiency and economy has grown to such proportions that the results, when reduced to type, have become too great a burden for any one issue of the *Railway Age Gazette*. Again, our plans for the future with respect to mechanical department problems that must necessarily be covered thoroughly in the columns of the *Railway Age Gazette*, because of their value and interest to officers in other departments, influenced the change."

Motive power department problems, interests and activities in all of their different phases and sub-divisions will be the field of the *American Engineer*. The plans of the editors are for a continual growth along the lines already clearly marked to those familiar with the two publications now combined in it.

NEW BOOKS

Proceedings of the Third Annual Convention of the International Railway Fuel Association, held at Chattanooga, Tenn., May 15, 1911. Secretary, D. B. Sebastian, fuel agent, Rock Island Lines, La Salle Street Station, Chicago. 238 pages. Price, paper, 35 cents; cloth, 75 cents.

The growing importance of the Fuel Association is indicated by the valuable papers relating to locomotive fuel published in this volume of the proceedings of the third annual convention. The secretary reports that the membership is now 367, showing a gain of 116 members. The list of papers is as follows: Fuel Investigation under the Bureau of Mines, by J. E. Holmes; Oragnization of a Railway Fuel Department, by T. Duff Smith, fuel agent, Grand Trunk Pacific; The Use of Petroleum for Locomotive Fuel, by Eugene McAuliffe, fuel agent, Frisco Lines; Purchase of Coal on a Mine Run Basis, by A. A. Steel, professor of mining at the University of Arkansas; Railway Fuel in Relation to Railway Operation, by R. Emerson; Testing of Locomotive Fuel, by F. O. Bunnell, engineer of tests, Rock Island Lines.

Proceedings of the Master Car and Locomotive Painters' Association. 136 pages. 6 in. x 9 in. Secretary, A. P. Dane, Reading, Mass.

The proceedings of the forty-second annual convention, held at Atlantic City, N. J., September 12 to 15, have recently been issued. As is usual it contains a list of the members of the association, mentioning those present at the last convention. This convention was one of the best the association has held for a long time, and the committees are to be congratulated upon the very complete reports presented. Among the interesting topics are the reports of the Information Committee, Test Committee, the papers on the Best Method of Finishing the Interior of Steel Passenger Cars, the essay on the Value of Chemical and Practical Tests of Railway Paint Shop Materials and papers on the Experience and Suggestions as to How Other Departments May Hinder or Help the Paint Department. The complete addresses given by F. W. Brazier and Eugene Chamberlain, both of the New York Central Lines, are included. An account of this convention was given in the Shop Section of the *Railway Age Gazette* for October 1, 1911.

EXPERIMENTAL 4-6-2 TYPE LOCOMOTIVE

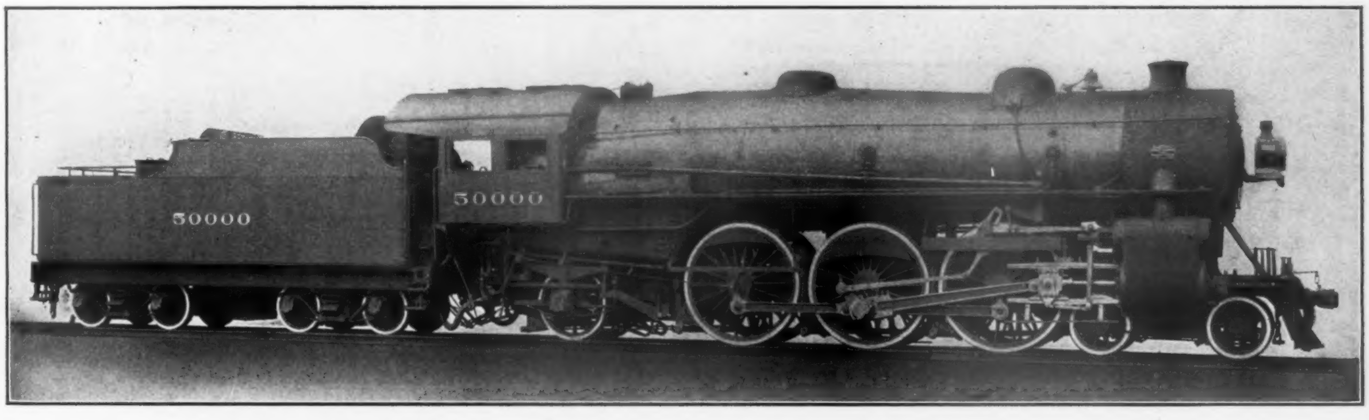
Pacific Type Locomotive No. 50,000 Designed and Built by the American Locomotive Company at Its Expense Has Developed in Actual Service 1 Horse Power for Each 121.4 lbs. Total Weight. Twenty-five Per Cent. More Efficient than the Ordinary Pacific Type Locomotive.

Desiring to determine the limits to which the efficiency and capacity of a passenger locomotive of standard wheel arrangement could be developed without exceeding conservative weight limitations, the American Locomotive Company designed and built at its own expense locomotive No. 50,000 which in its own field of service marks as striking an advance in locomotive construction as did the Mountain type of the Chesapeake & Ohio.* Maximum sustained capacity per unit of weight was the object of the designers and advantage was taken of the latest approved developments in locomotive design and of fuel saving devices. It embodies the latest knowledge of proportions and improvements in the design of details, combined with the use of the very best materials obtainable.

In working up the design the builders were untrammeled by any outside specifications, or the necessity of conforming to any railway's existing standards, and thus had a free hand to embody their ideas of the best locomotive engineering practice. This is probably the first instance in the history of American locomotive development in which locomotive builders on their own initiative and at their own expense have constructed a locomotive—not to introduce a new principle—but to secure information as to the maximum possibilities in economy and capacity inherent in already accepted principles with the view of advancement of locomotive design. As might be expected the design incorporates a number of innovations, several of which have, even in the short time which this locomotive has been in service, proved to be so great an advance that they have already been applied to other locomotives built by this company and can now almost be regarded as standard practice. This is particularly noticeable in the case of the outside steam pipes connecting to the top of the steam chest. The advantage of this arrangement is so apparent as to meet with practically universal adoption on recent orders.

Maximum sustained capacity of course means maximum boiler capacity, and every effort was made to hold the weight of all other parts of the locomotive to the minimum, both by the use of improved designs and of the very best quality of materials, so that the boiler could be enlarged without exceeding conservative wheel loads. The result of this is particularly striking in connection with the cylinders in which vanadium cast steel was used with cast iron bushings in the cylinder and valve chambers, resulting in a saving of about 4,000 lbs. as compared with cast iron cylinders having inside steam pipes. Also with the trailer truck where a saving of nearly 3,000 lbs. was effected by improved design. Again the use of the pressed steel bumper beam and pilot saved 1,500 lbs. as compared with the cast steel bumper beam and wooden pilot. Similar methods were followed throughout the whole design, as is illustrated in the accompanying table, with the most gratifying results, not only in saving of weight, but of actual improvement and strengthening of the various details.

	Weights.	
Parts.	50,000.	Loco. X.
Frame cross ties (2)	1,380 lbs.	1,630 lbs.
Link supports	1,014 lbs.	1,350 lbs.
Link yoke	720 lbs.	1,058 lbs.
Link yoke bracket	180 lbs.	540 lbs.
Bumper bracket	1,150 lbs.	1,580 lbs.
Equalizer fulcrum	554 lbs.	1,148 lbs.
Front bumper	575 lbs.	1,750 lbs.
Pilot	343 lbs.	700 lbs.



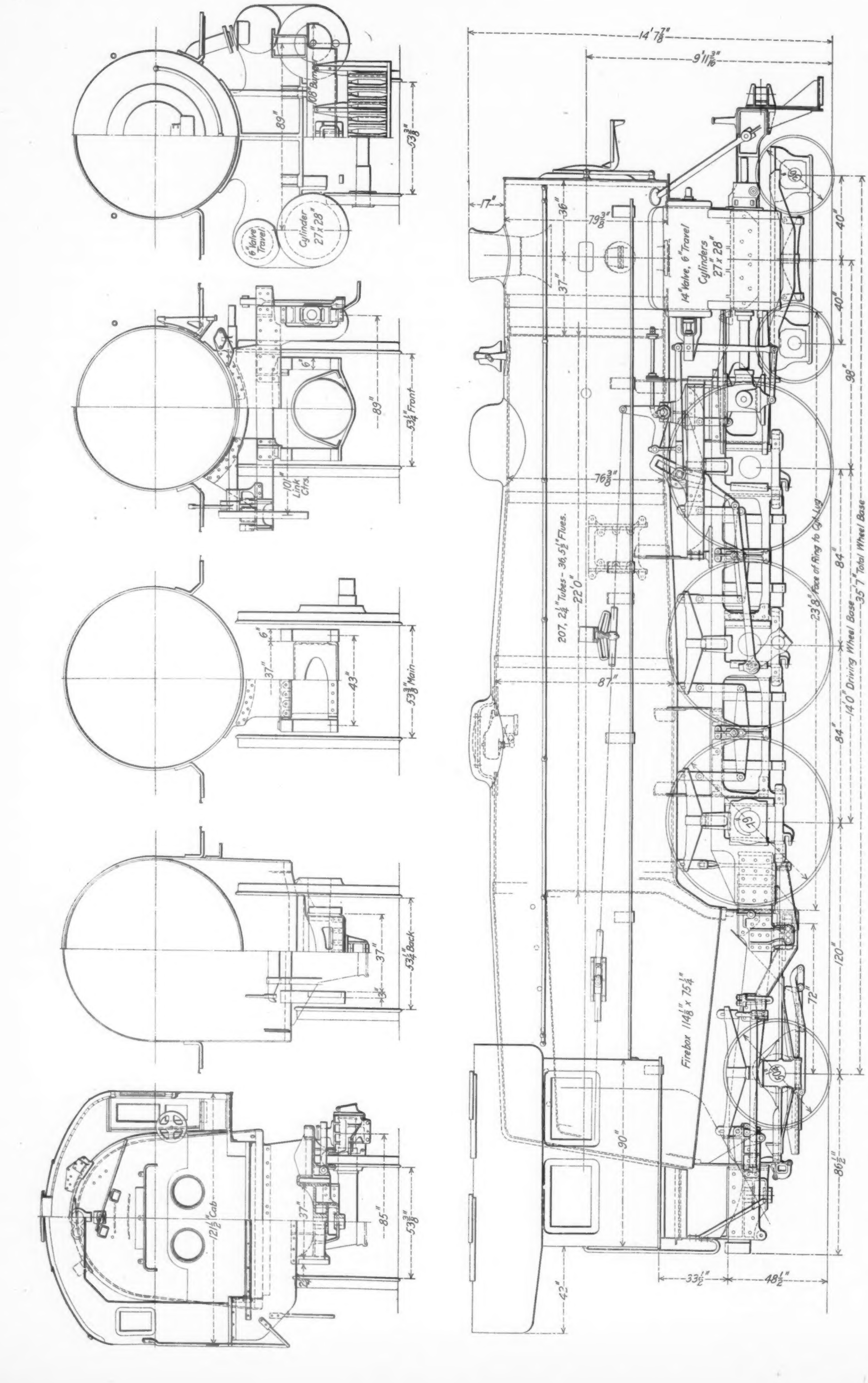
"Maximum Power Per Unit of Weight" Was the Object of the Design of This Locomotive.

As an indication of what was accomplished in saving weight of various parts by improved design and material, the above comparison with a Pacific type of approximately the same size, but of conventional design, is very impressive.

In the larger boiler thus secured, the utmost care was taken to give it the best proportions and the most carefully designed details. Approved fuel saving devices, viz., the superheater and brick arch, were of course applied, the former being the largest of the Schmidt type yet installed on an American locomotive. A moderate steam pressure was decided on and the cylinders were carefully proportioned to the boiler, so as to give the most economical point of cut-off at the maximum boiler capacity. In the table on the next page are given the boiler dimensions of No. 50,000, as compared with five other locomotives.

In this table the equivalent heating surface is figured on the basis of 1 sq. ft. of superheater heating surface being equivalent to 1½ sq. ft. of evaporative heating surface. Service tests on

*For illustrated description see *American Engineer*, October, 1911, page 381, and *Railway Age Gazette*, September 22, page 555.

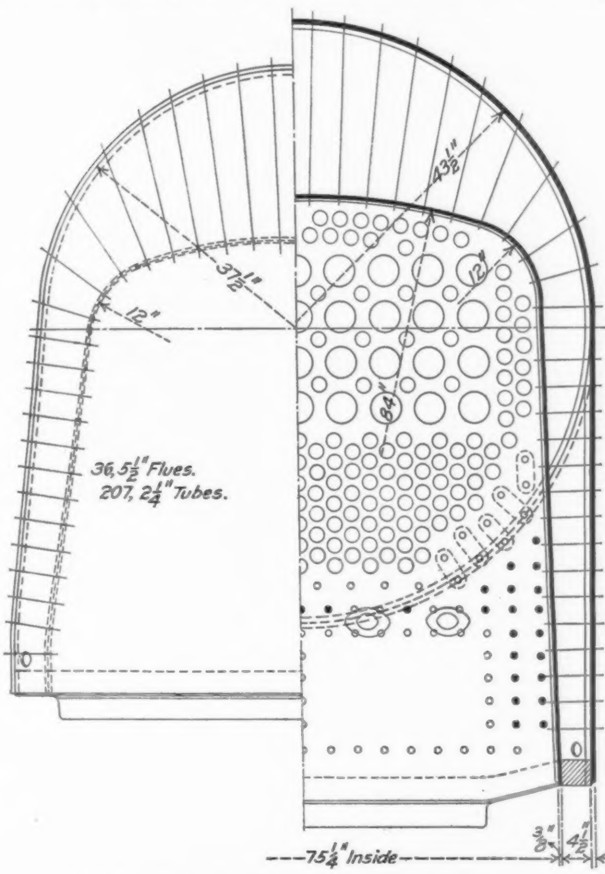


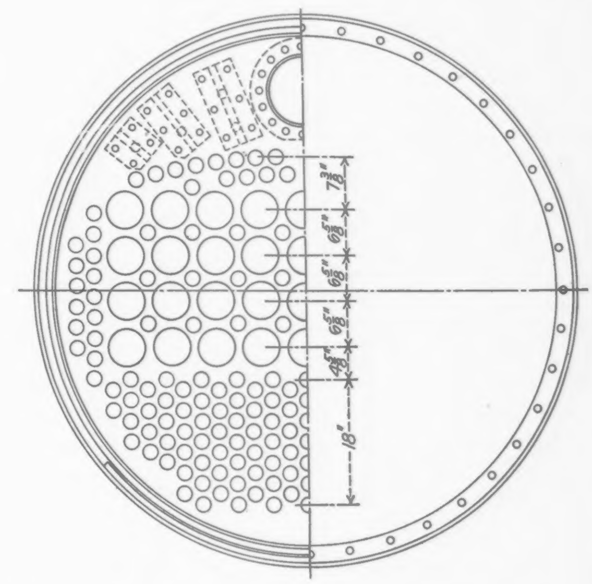
Locomotive No. 50,000 Designed and Built by the American Locomotive Company to Secure Information as to the Maximum Possibilities of the Pacific Type Within Reasonable Weight Limitations.

superheater locomotives indicate that while this value may be approximately correct for average conditions, when the boiler is forced to its maximum the superheating surface becomes more of a greater proportionate capacity than is indicated by the figures of equivalent heating surface. Compared with another locomotive of equal weight, also equipped with a superheater,

Locomotive.	50,000	A.	B.	C.	D.	E.
Total weight	269,000 lbs.	269,000 lbs.	271,000 lbs.	270,000 lbs.	266,500 lbs.	263,800 lbs.
Type of boiler	Conical	Conical	Conical	Straight	Conical	Ext. W. T.
Steam pressure	185 lbs.	200 lbs.	200 lbs.	210 lbs.	200 lbs.	205 lbs.
Diameter drivers	79 in.	79 in.	79 in.	80 in.	79 in.	74 in.
Tractive effort	40,800 lbs.	30,900 lbs.	30,900 lbs.	33,400 lbs.	29,200 lbs.	43,400 lbs.
Diameter at front	76⅜ in.	72 in.	72 in.	79¾ in.	72 in.	78 in.
Largest diameter	87 in.	83 in.	83 in.	83¼ in.	83 in.	......
Firebox, length	114 in.	108⅛ in.	108½ in.	111 in.	108⅛ in.	120 in.
Firebox, width	75¼ in.	75¼ in.	75¼ in.	80¼ in.	75¼ in.	84 in.
Grate area	59.75 sq. ft.	56.5 sq. ft.	56.5 sq. ft.	61.8 sq. ft.	56.5 sq. ft.	70 sq. ft.
Tubes, number	207	175	242	343	382	389
Flues, number	36	32	28	......	......	......
Tubes, diameter	2¼ in.	2¼ in.	2 in.	2¼ in.	2 in.	2¼ in.
Flues, diameter	5½ in.	5½ in.	5⅜ in.	......	......	......
Tubes, length	22 ft.	21 ft. 6 in.	21 ft. 6 in.	21 ft.	20 ft.	21 ft.
Total heating surface	4,048 sq. ft.	3,424 sq. ft.	3,784 sq. ft.	4,427 sq. ft.	4,210 sq. ft.	5,017 sq. ft.
Superheater heating surface	897 sq. ft.	765 sq. ft.	705 sq. ft.	......	......	......
Equivalent heating surface	5,394 sq. ft.	4,572 sq. ft.	4,842 sq. ft.	4,427 sq. ft.	4,210 sq. ft.	5,017 sq. ft.

valuable in proportion, and therefore for maximum service conditions the boiler capacity of the superheater locomotives in this table are probably under-rated and the boiler on No. 50,000 is but having less superheating surface, the 50,000 in service tests showed an average economy of 13 per cent. in fuel per indicated horse power hour. In these tests the average superheat



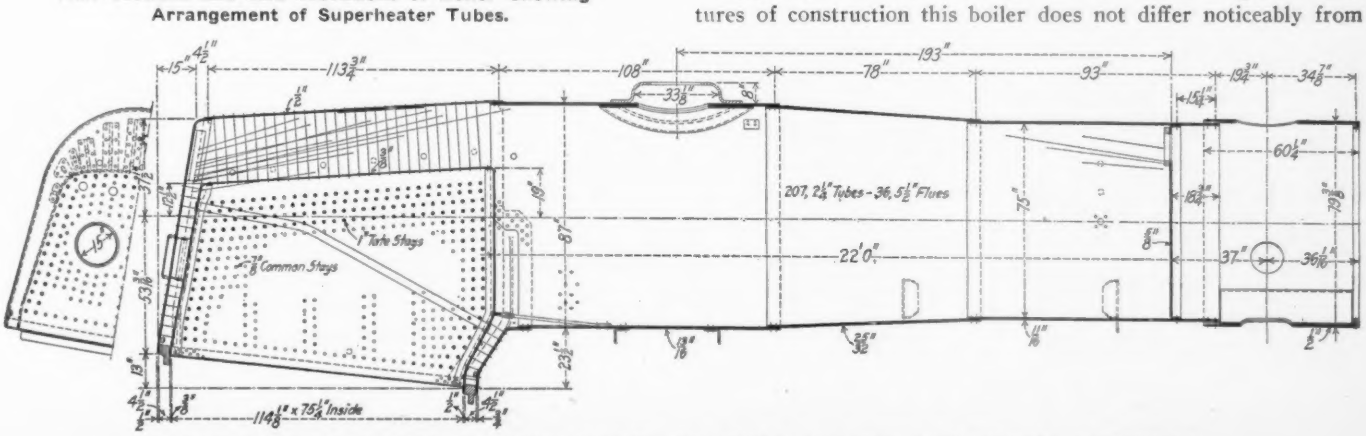


Half-Sections and End Elevations of Boiler Showing Arrangement of Superheater Tubes.

was 276 deg., and the maximum 341 deg., which is the greatest amount of superheat ever obtained on an American locomotive. The superheater is of the Schmidt design, known as the type "A" of the Locomotive Superheater Company. It has a top header and 36 double looped superheater elements.

In addition to the superheater this boiler is also fitted with a Security brick arch of the latest design which further increases its capacity by at least 10 per cent.

Reference to the illustration will show that in general features of construction this boiler does not differ noticeably from



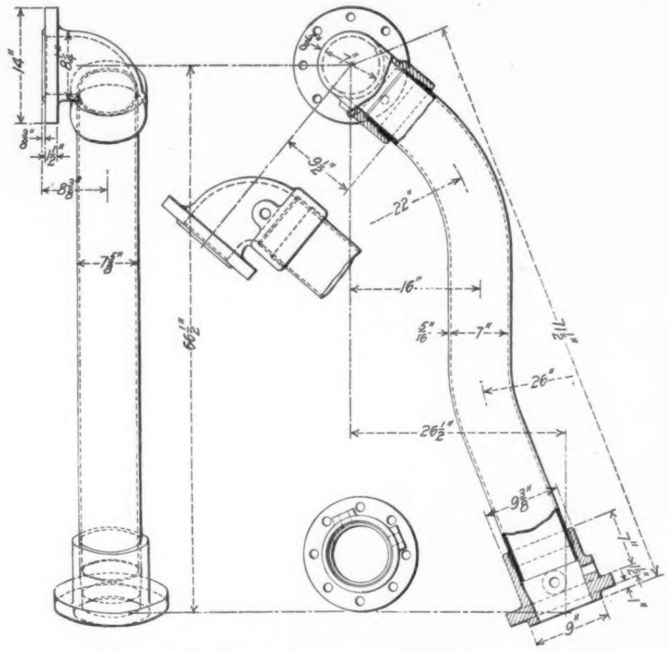
The Keynote of Sustained Locomotive Capacity—the Boiler—Has Been Most Carefully Proportioned.

previous designs of the same builders. The increase in diameter between the front end and the dome course is considerable, resulting in maximum steam space with minimum weight and off-setting to a considerable extent the effect of the very low dome on the moisture in the steam. The 2¼-in. tubes are arranged with ¾-in. bridges, and are carefully located to give the best circulation. A liberal depth of throat sheet has been obtained, allowing plenty of space below the brick arch for a liberal depth of fire. There are two 15-in. circular fire doors. Although the boiler carries but 185 lbs. pressure, it is evident from the thickness of the sheets that it is capable of an increase in this respect, if desirable.

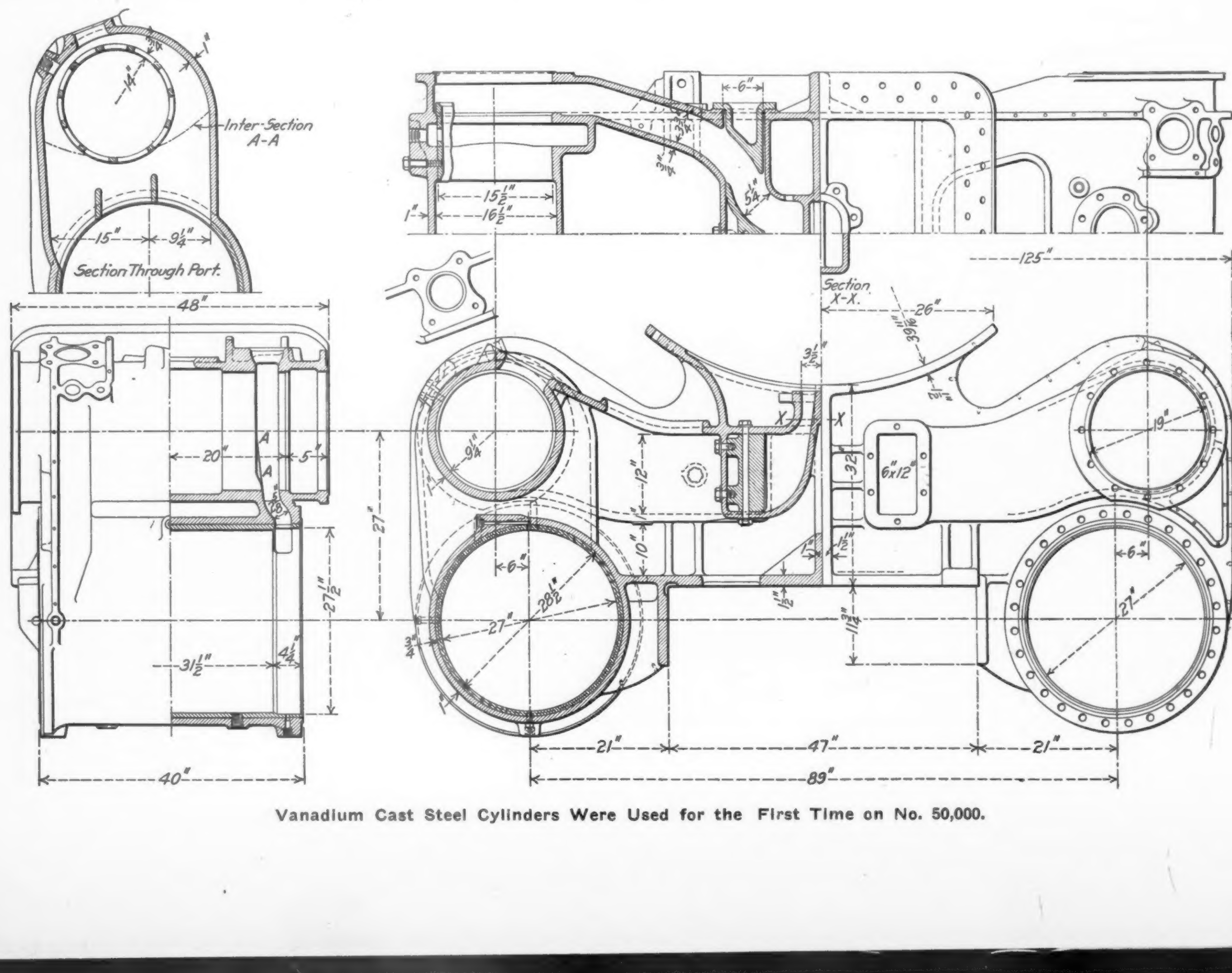
Outside Steam Pipes.—One of the illustrations shows the design of the outside steam pipe, which is the latest arrangement of the American Locomotive Company. It is made of a 7-in. wrought iron pipe bent to the proper form and terminating in an elbow connecting to the superheater header at the upper end, and to a cast iron flange at the lower end. The pipe is secured to these castings by a double row of soft iron rivets. Where it passes through the smokebox there is a stuffing box arranged to permit a movement of the pipe due to expansion, but to prevent the entrance of air around it. One of the illustrations shows a view of the front end well illustrating the arrangement and advantages of this design.

Cylinders.—This is the first instance of the use of vanadium cast steel for cylinder castings. The use of this material together with the outside steam pipes has not only saved about 4,000 lbs. in weight, but results in a decided simplification and improvement of the casting. The elimination of the high pressure steam passage in the cylinder casting also reduces the probability of the cylinders being cracked in service by temperature stresses. The cylinders are fitted with vanadium cast iron bushings ¾-in. thick, and the valve chamber bushings are of the same material. The bushings in both cases are secured in place. It will be noted that provision is made for lubrication at the center of the piston stroke. The use of the outside steam pipes permits a much better attachment between them and the cylinders, where 8 bolts are used in this case in place of the customary 4 or 6. It will also be noted that a leak at this joint is not as serious a matter as when the joint is inside of the smokebox, as it will have no effect upon the vacuum.

Vanadium steel is also used for driving wheel centers, frames, rods, crankpins, piston rods, valve motion parts, and springs. The design of these parts does not differ materially from the usual construction, but their weight has been reduced decidedly by careful distribution of the metal.

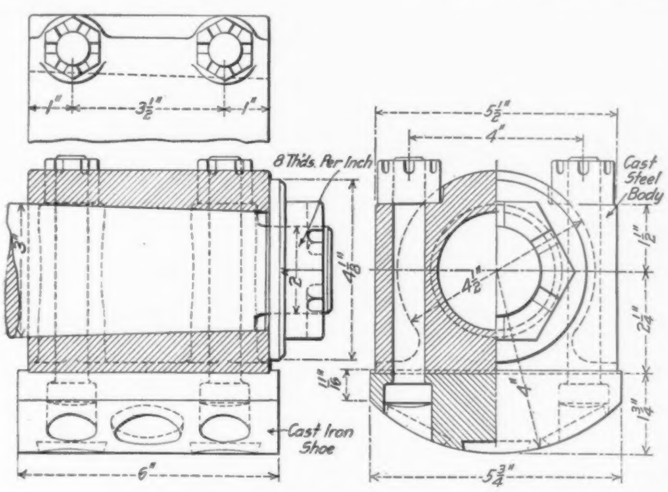


Outside Steam Pipes Were First Tried on No. 50,000.



Vanadium Cast Steel Cylinders Were Used for the First Time on No. 50,000.

Screw Reverse Gear.—Locomotive No. 50,000 was the first one in this country to use the screw reverse gear, which was illustrated and described in connection with the Mountain type locomotive of the Chesapeake & Ohio.* It is generally recognized that in the larger locomotives, other than the Mallet type, where a power reverse gear is generally used, it is becoming very difficult to handle the ordinary reverse lever, and there is no doubt but that there is considerable loss in economy in opera-



Shoe on End of Extended Piston Rod.

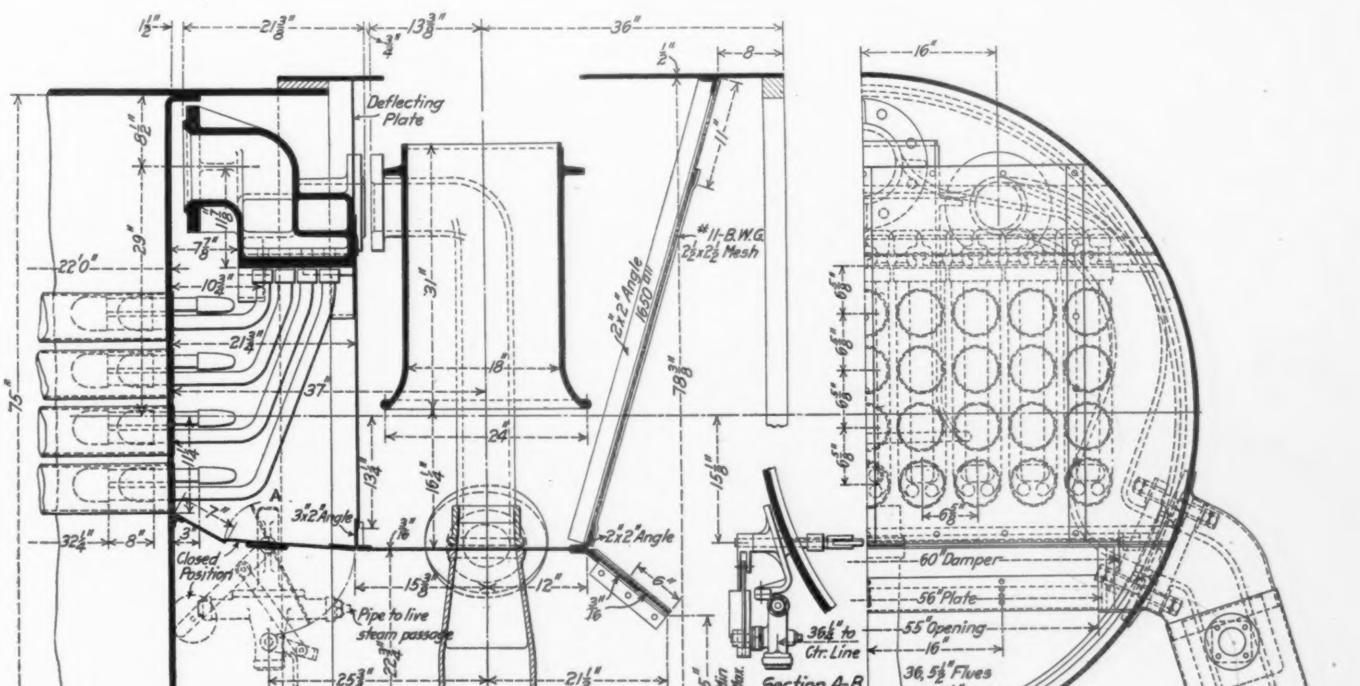
tion from the fact that it is often dangerous to alter the point of cut-off when operating at high speed. The screw reverse gear as designed for this locomotive gives about 11 times the leverage obtained from the usual reverse lever, and of course permits the adjustment of cut-off to any desired point. One of the illustrations shows a view in the cab well illustrating how conveniently this apparatus may be located. With the screw reverse gear the engine can be reversed completely in from 4 to 6 seconds.

While the screw reverse gear is not new, having been in use for many years on foreign roads, the design as applied on this locomotive differs in many particulars from the usual foreign practice. It provides a straight line pull without off-sets and the use of the screw inside of tubular connections on the same longitudinal axis as the reach rod better adapts it to the greater weights of valve motion parts in American practice.

Valve Stem Guide.—An important improvement in detail design first introduced on locomotive No. 50,000, but which has now become somewhat familiar because of its use on other locomotives, recently built by the same company, is the self-centering guide for the valve stem. As will be seen from the illustration of the builder's standard arrangement of this device, it consists of a guide made integral with the back head of the piston valve chamber and so constructed as to be easily adjusted for wear. The chief advantages of this arrangement are that it can be erected, taken down and replaced without any lining up, at the same time insuring that the valve stem guide is absolutely in line with the piston valve chamber. This saves all the time that is spent in lining up the valve stem guide of the ordinary construction employed with the Walschaert valve gear when it is necessary to take down the valve motion. This arrangement is self supporting, so that no bracing from the guides or any other source than the cylinder is required. It permits the use of a straight design of combination lever without forks, which is connected to the valve stem crosshead by a pin passing through its wings, thus affording greater lateral stability than is obtained in other designs.

Extended Piston Rod Guide.—A design of guide for the extended piston rod, which in view of the general adoption of this practice on locomotives equipped with superheaters has a wide usefulness, is shown in one of the illustrations. This device, like the valve stem guide, is self-centering, and can be removed and replaced in position without lining up, and at the same time exactly coincides with the longitudinal axis of the cylinder. It

*See *American Engineer*, October, 1911, page 387, and *Railway Age Gazette*, September 22, page 555.

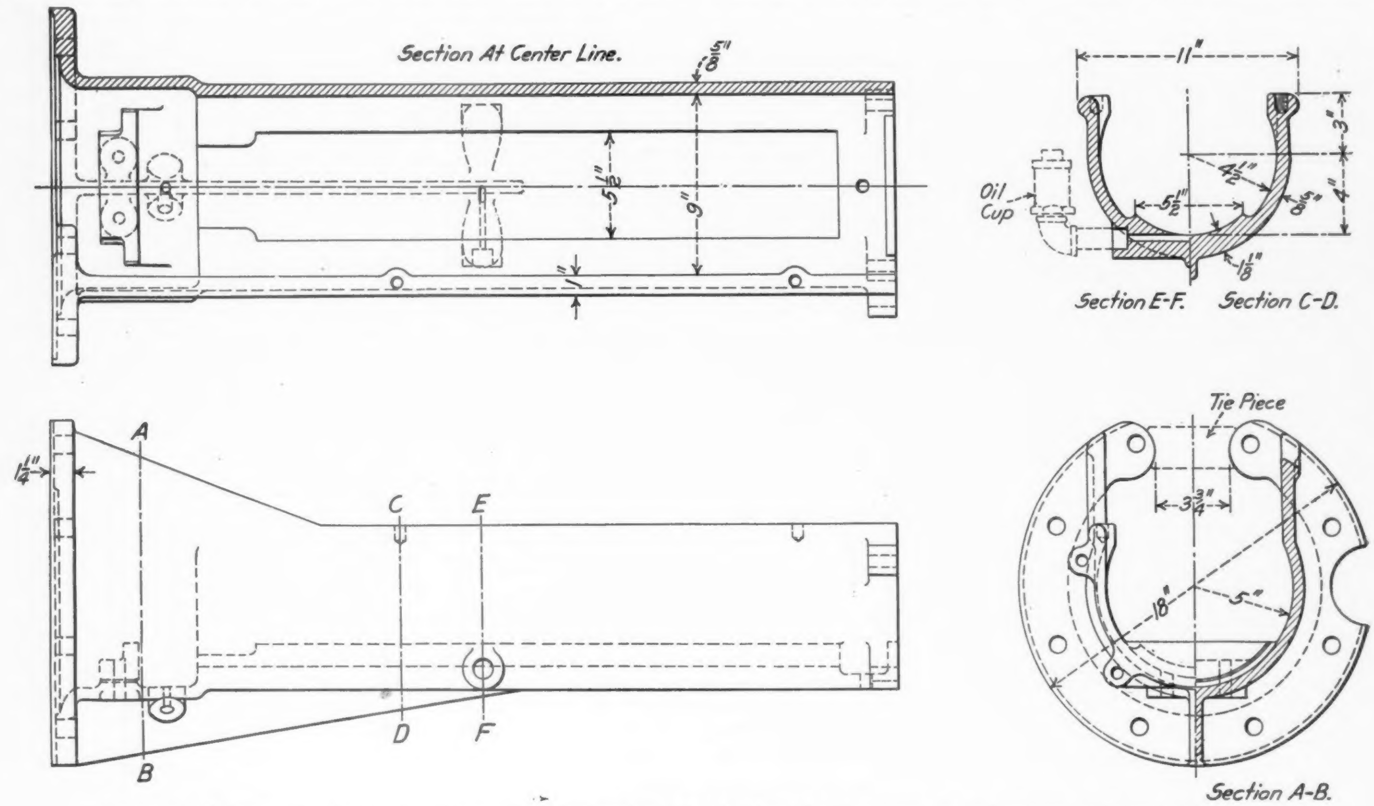


The steam pipes here shown have since been changed to the improved type shown on page 8.

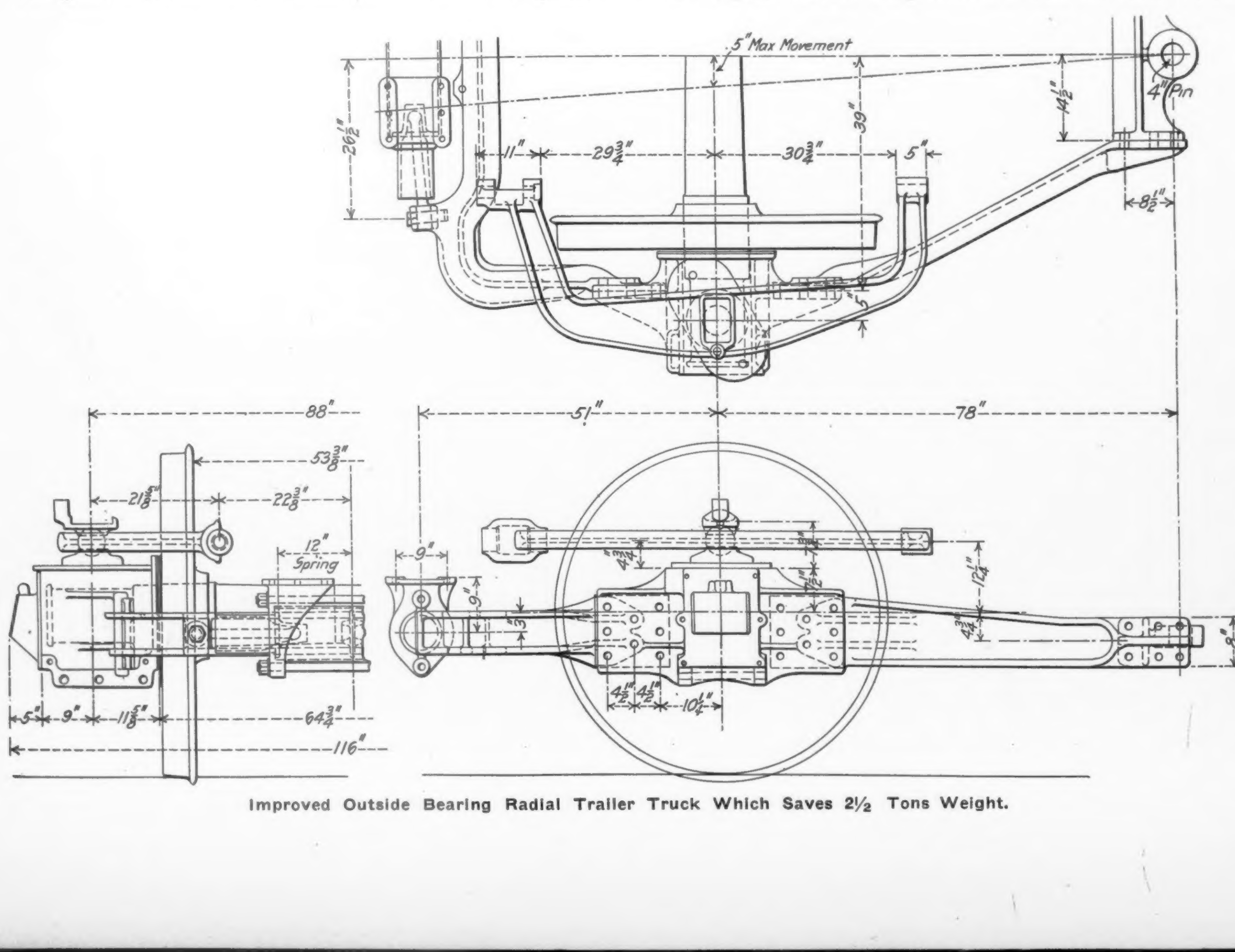
Front End Arrangement of Locomotive No. 50,000.

consists of a cast iron shoe fitted to the extended end of the piston rods and composed of a cast steel body to which the shoe is firmly screwed by four bolts. The shoe slides on a guide secured to the cylinder head. The circular face of the guide registers with a corresponding face on the front cylinder head.

The guide surface is struck from the center of the cylinder and the guide is so constructed that it may be bored out and faced off at one setting of the machine. The bearing surfaces of the shoe and guide are made radial to provide sufficient wearing surface to insure continuous service for 2 or 3 years without requiring adjustment to linings or repairs of any kind. Furthermore, the guide surface being concentric with the center of the

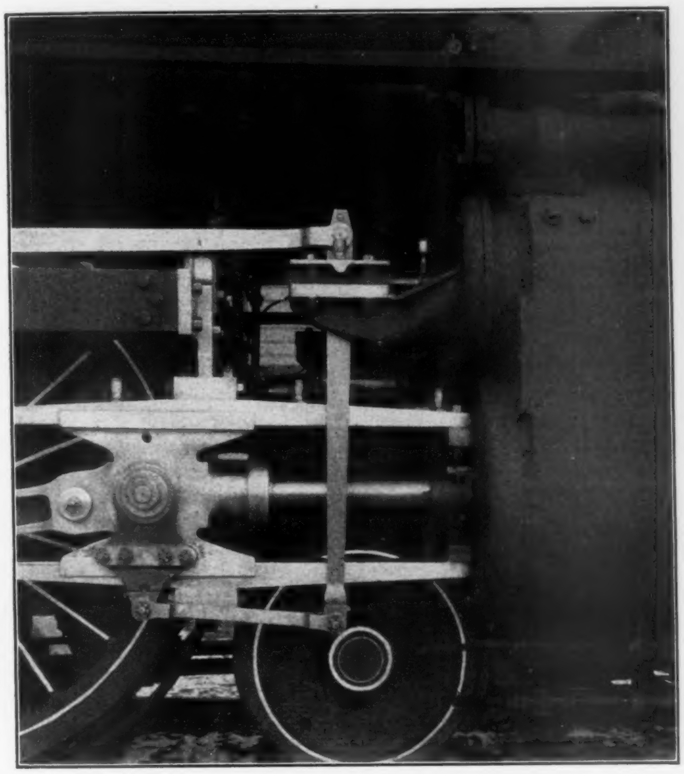


Latest Self-Centering Guide for Piston Rod Extension Which May Be Removed and Replaced Without Lining Up.



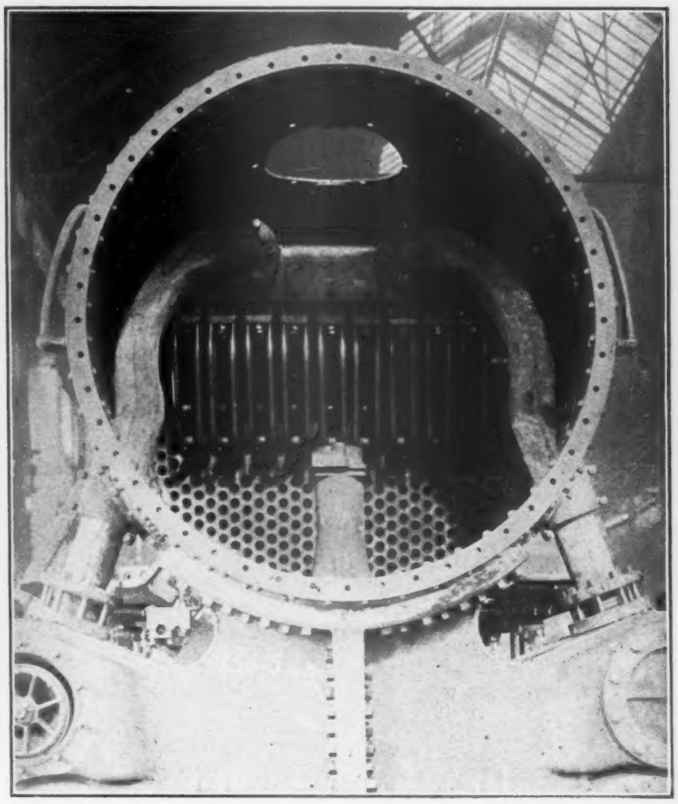
Improved Outside Bearing Radial Trailer Truck Which Saves 2½ Tons Weight.

cylinder, any refinement in adjustment between the shoe on the front of the rod and the main crosshead is unnecessary, since while the crosshead works on a flat guide, the piston rod shoe will swing around on the center of the cylinder and thus always take a fair bearing without cramping. A dust proof covering is provided, and as will be seen from the illustration, the casing and guide are so constructed, the latter being of horseshoe form, that the guide can be removed, irrespective of whether the engine is on the front or back center, without removing the pilot and bumper.



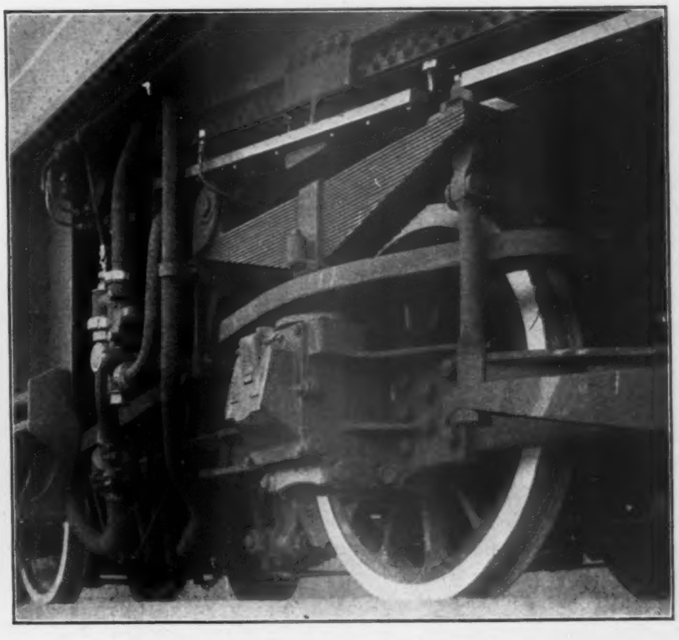
Self-Centering Valve Stem Guide.

Outside Bearing Trailing Truck.—A saving in weight of from 4,500 to 5,000 lbs. was effected by the application of an improved design of outside bearing radial truck in place of the former type applied by this company, which entailed the use of outside supplementary frames secured to the slab rear portion of the main frames by heavy cast steel filling pieces. This type of truck had been previously successfully applied and has since become the builder's standard design for Pacific and Mikado type locomotives. It provides for a universal adjustment of the springs to the rise and fall of the engine and a resistance to transverse



View of a Front End Showing Some of the Advantages of the Outside Steam Pipes.

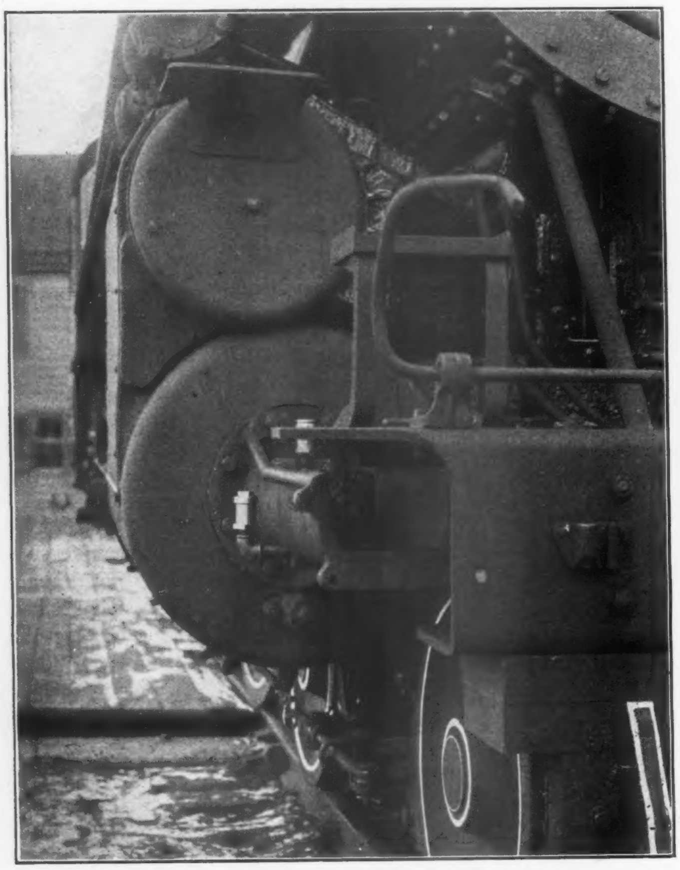
Operating Wheel for Screw Reverse Gear.



Outside Bearing Trailer Truck.

motion through the combined action of the spring centering device and the inclined friction plates, which operate to restore the truck to its normal central position on entering a tangent after passing through a curve. Experience shows that it greatly improves the riding qualities of the locomotive.

Certain modifications in the structural features introduced in the builder's present standard construction of this detail, which is illustrated herewith, have served to still further improve the original design. This change consists in the use of a drop forged sphere made in halves riveted together for supporting the spring seat, in place of the double trunnion arrangement originally employed. This arrangement provides the same flexibility in the spring supports as before, whereby the easy riding qualities are secured, and at the same time the parts in the older construction which might be liable to accumulate lost motion and loose bolts are eliminated. Moreover, all the spring seats being in compression any wear and lost motion which may accumulate



Pressed Steel Bumper Beam and Piston Rod Extension Guide.

is automatically taken up, the design of the truck being thus still further improved from the maintenance standpoint.

Pressed Steel Bumper and Pilot.—Further evidence of the refinement in detail carried out in this locomotive to keep the weight of every part down to a minimum consistent with strength is furnished by the use of a pressed steel bumper and pilot. Pressed steel pilots have been very successfully employed on the Lake Shore & Michigan Southern. Compared with an ordinary design of cast steel bumper the pressed steel type here employed weighs approximately 1,200 lbs. less, while as between the pressed steel and wooden pilot there is a difference of 350 lbs., a total saving of some 1,500 lbs. being effected in these two details alone.

Locomotive No. 50,000 sets a new high mark for the capacity and economy attainable within the limitations of conservative wheel loads in a modern passenger locomotive designed for sustained high speed service with heavy loads. It has also pointed a way by which present commonly accepted practice may be greatly improved by better proportion of boiler to engine capacity, greater refinement in the design of details and modifications of present standards, the best use of fuel saving devices, the value of which has been tried and proved in service and the latest developments in material.

The general dimensions, weights and ratios are given in the following table:

General Data.

Gage	4 ft. 8½ in
Service	Passenger
Fuel	Bit. coal
Tractive effort	40,800 lbs.
Weight in working order	269,000 lbs.
Weight on drivers	172,500 lbs.
Weight of engine and tender in working order	430,500 lbs.
Wheel base, driving	14 ft.
Wheel base, total	35 ft. 7 in.
Wheel base, engine and tender	68 ft. 2½ in.

Ratios.

Weight on drivers ÷ tractive effort	4.26
Total weight ÷ tractive effort	6.68
Tractive effort × diam. drivers ÷ heating surface*	596.00
Total heating surface* ÷ grate area	90.50
Firebox heating surface ÷ total heating surface,* per cent	4.60
Weight on drivers ÷ total heating surface*	32.00
Total weight ÷ total heating surface*	49.60
Volume both cylinders, cu. ft	18.60
Total heating surface* ÷ vol. cylinders	298.00
Grate area ÷ vol. cylinders	3.20

Cylinders.

Kind	Simple
Diameter and stroke	27 in. x 28 in.

Valves

Kind	Piston
Diameter	14 in.
Greatest travel	6½ in.
Outside lap	1¼ in.
Inside clearance	¼ in.
Lead in full gear	Forward, ⅛ in.; Backward, ½ in.

Wheels.

Driving, diameter over tires	79 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	11 in x 12 in.
Driving journals, others, diameter and length	10½ in. x 12 in.
Engine truck wheels, diameter	36 in.
Engine truck, journals	6½ in. x 12 in.
Trailing truck wheels, diameter	50¼ in.
Trailing truck, journals	8 in. x 14 in.

Boiler.

Style	Conical
Working pressure	185 lbs.
Outside diameter of first ring	76⅜ in.
Firebox, length and width	114⅛ in. x 75¼ in.
Firebox plates, thickness	⅜ in. x ½ in.
Firebox, water space	4½ in.
Tubes, number and outside diameter	207—2¼ in.
Tubes, superheater	36—5½ in.
Tubes, length	22 ft.
Heating surface, tubes	3,800 sq. ft.
Heating surface, firebox	248 sq. ft.
Heating surface, total	4,048 sq. ft.
Superheater heating surface	897 sq. ft.
Grate area	59.75 sq. ft.
Smokestack, diameter	18 in.
Smokestack, height above rail	14 ft. 7⅞ in.
Center of boiler above rail	9 ft. 11 5/16 in.

Tender.

Tank	Water bottom
Frame	13 in. channels
Wheels, diameter	36 in.
Journals, diameter and length	5½ in. x 10 in.
Water capacity	8,000 gals.
Coal capacity	14 tons

*Equivalent heating surface equals 5,394 sq. ft.

New Factor in World's Coal Supply.—Statistics indicate that the coal fields of New Mexico, which produce a high grade of both bituminous and semi-bituminous coal, will play no unimportant part in the world's supply of coal. During 1910 the output was 3,508,221 short tons, with a value of $4,887,151 against 2,801,128 tons in 1909, a gain of 707,193 short tons or 25.25 per cent. The value of the product increased from $3,619,744 to $4,877,151, a gain of $1,257,407, or nearly 35 per cent. The coal produced in this district is shipped in large quantities into Mexico and the newly settled districts of New Mexico, Arizona and California. The domestic demand for New Mexico coal in 1910 was so great that the operators were unable to fill their orders promptly. According to an estimate of the U. S. Geological Survey, the original coal supply of New Mexico was 163,780,000,000 tons, so that the exhaustion to date represents approximately 0.03 of 1 per cent. of the original supply. These figures do not include several newly discovered fields.

RAILWAY MECHANICAL ASSOCIATIONS

Advantages of Membership in These Associations. This Article Was Submitted in a Recent Competition on "The Benefits of Attending Conventions"

BY C. C. LEECH
Foreman, Pennsylvania Railroad, Buffalo, N. Y.

On the editorial page of the Shop Section of the *Railway Age Gazette* of September 1, 1911, we find this statement: "During the past four months the *Railway Age Gazette* has published reports of the annual conventions of a considerable number of railway mechanical organizations. It has been suggested that there are too many of these associations. We do not believe this is so if these associations are doing the work for which they were intended. The question is: Are they properly conducted and are they giving the best results possible? If they are then they should receive the hearty support from the higher executive officers."

To my mind the benefits of a properly conducted association are three-fold: First, to the man himself; second, to his company; and third, to the other men attending the convention, or who are members of the association. The broadening and educational advantages of attendance at a well-conducted convention are very many indeed. The man gets away from the little world of his own shop or department, and out of the rut and daily grind of shop routine. His mind is taken off the worries, large and small, of shop management, for a time at least. He warms up and expands in the sun of new acquaintances, new scenes and new ideas.

It is a pleasant sensation to be called to the office of a superior and be requested to prepare to attend a coming convention. It touches a man's pride to feel that his company or employer thus recognizes his worth, and it is an indication that his efforts along the line of self-improvement and shop improvement are not going on unnoticed. He determines to make good and to get thoroughly saturated with new ideas for the benefit of his company and others, and to be ready to give in his turn new thoughts and suggestions to the other members in attendance at the conventions. It is surprising to find how many different ideas the other fellow may have on any subject he may suggest. Perhaps for years he has performed certain work in a special way that he considered the best and thought could not be improved upon, when, lo, someone stands up in the convention who has perhaps come from some shop a thousand miles away that he has never heard about, and in a few words tells a way of performing the work that is so much better than his method that he makes the change as soon as he returns home, and as a result has the satisfaction of increased output and less unit cost.

An opportunity to see all the best and latest in tools, machinery and supplies is given to the men that attend the conventions. It is concentrated in one place and each exhibit is presided over by the best demonstrators and salesmen the manufacturers have. They recognize that the men who come to the conventions are the ones who are consulted in regard to the purchase of new machinery, and whose recommendations are received with respectful attention by their superior officers. These men are loaded up with information and facts that they gather in their travels from one city to another, and if our convention attendant makes friends with them, which he will find is not difficult, he will get many good points and valuable suggestions to take home with him. The wide-awake supply man travels more miles in a week, meets more mechanical men and sees more machinery and labor-saving devices than a master mechanic or shop foreman does in a year. At the convention we have him in the plural number, and the opportunity to extract all the information we possibly can out of him should by no means be neglected.

We may be selected to prepare a paper on one of the subjects assigned for discussion at the convention. While the first thought is to decline the honor, on account of the additional work it will entail, the fact remains that it is really a great educational opportunity and should be accepted at once. We may think when starting in to prepare the paper that we already understand all the salient points of the subject and all there is to do is to clothe our thoughts in a readable and intelligent form. But as we begin to concentrate upon the work and further add to our store of knowledge by careful and conscientious study of the subject, it is usually found that it has many ramifications and phases that lead in directions unthought of before. The work becomes fascinating, and when the paper is finally completed and sent to the committee we cannot help but feel a pride in our work and will, at the same time, have helped ourselves in an educational way to a remarkable extent.

Then there follow the reading and discussion of the paper at the convention, sure to be of great benefit and interest, which will bring out still further thoughts and information. An excellent and striking example of this is shown in the splendid paper presented by F. C. Pickard, master mechanic of the Cincinnati, Hamilton & Dayton at the recent convention of General Foremen's Association on How Can Shop Foremen Best Promote Efficiency? I quote from the editorial note in the *Railway Age Gazette* which said: "By study and correspondence with the members of the association he arranged 44 questions under 4 heads—organization, accounting and supervision, handling of material and shop kinks and methods." When the paper came before the convention some 24 men, representing 12 different roads, took part in the discussion, and fully 250 distinct ideas were brought out bearing on the various divisions of the subject. And even at that an important part had to be omitted as time would not permit of its further discussion. Surely it needs no further argument to prove the immense benefit of this exchange of ideas to the men themselves and to their companies.

Coincident with these benefits is the confidence it gives the man to stand up in the convention and express his ideas in an orderly and intelligent manner. Not an easy matter to the majority of men, but it can be acquired by just this practice and is an invaluable experience. It is also a great aid in the daily routine of shop work. The foreman or shop superintendent who can express himself in clear, forcible style either in conversation or by letter, presenting facts in a few words, or covering information asked for in a few sentences, always attracts the notice of those in authority and commands respect. The ability to handle correspondence is an important step in the line of promotion that should not be neglected.

It was related to the writer recently that at one of the conventions held during the past summer a young man took so much interest in the proceedings and conducted himself in such an attractive way on the floor, presenting so many good ideas and practical suggestions, as to command marked attention. Later an official high in railway circles, who was looking for a man possessing just these qualities, was directed to him.

Another one of the benefits derived from convention attendance is the social companionship. Here we meet with men from north, south, east and west. Men from the village, town and city, and often if we are regular attendants we meet the same men year after year, and valuable and lasting friendships are made.

Again, while our attendance is primarily for work and study of the subjects presented for our discussion, the value and necessity of at least a little relaxation is recognized and nearly always plans are made for some pleasant form of entertainment after the business sessions. These are often enhanced by the presence of the wives and daughters of the members, rounding out these happy occasions with their charming and refining influence and adding that touch of color and brightness that makes pleasant memories of the convention hours.

Association members can do much for each other in the way of preferment and promotion, and we firmly believe that many owe their advancement in their chosen work to these influences.

In a general sense the members of any of these associations represent the ambitious and progressive men of their particular calling, men who have won promotion, because they had in greater measure than their fellows the ability and the qualifications necessary to success. They are the cream, and are the men headed straight for more responsible positions.

It is beyond any doubt to the best interests of the railways to encourage membership in the various associations, and in return the members should demonstrate their appreciation by showing in a tangible way the benefits they have received.

LAYOUT OF A SPIRAL

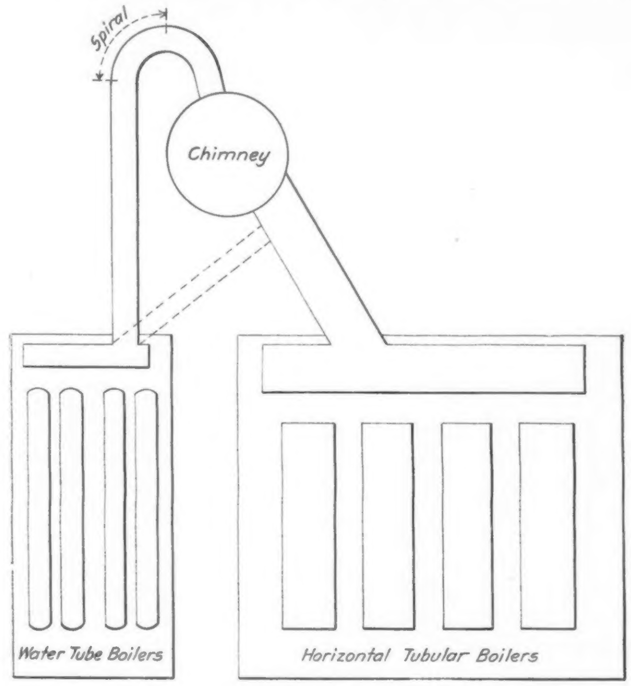
BY WILLIAM H. DAMON
Foreman Boiler Maker, Long Island Railroad, Richmond Hill, N. Y.

A short time ago it was found necessary to enlarge the power plant at the Morris Park shops of the Long Island Railroad, Richmond Hill, N. Y., by the addition of two water tube boilers. It was thought that the easiest and most practical way of conducting the smoke to the chimney would be by simply connecting the new flue into the old flue of the horizontal tubular boilers, as is shown by the dotted lines in the accompanying illustration. However, it was found that this arrangement greatly interfered with the draft of the horizontal boilers, and it became necessary to devise a new arrangement. It was considered advisable to enter the chimney from the side opposite the flue of the horizontal boilers, but in order to do this it was necessary to raise the new flue at an angle, and to reduce the resistance, one-half of the curve shown in the pipe had to be made in the form of a rectangular spiral. The layout of the spiral is shown herewith, the shape of the different sides being shown in their development.

Layout of Spiral.—First lay out a plan view of the spiral section as *A, B, C, D.* Divide the arcs into equal sections, as *a, b, c,* etc., and *f, h, n,* etc. The side view of the spiral, or its elevation, is shown by the figure *K F G M* and *K E H M, H E F G,* representing the cross section of the flue, and the distance *LK* the height of the spiral. Vertical lines are then projected down from the points on the arcs *AD* and *BC* intersecting the lines *KE, KF, MH* and *MG* as shown on the diagram.

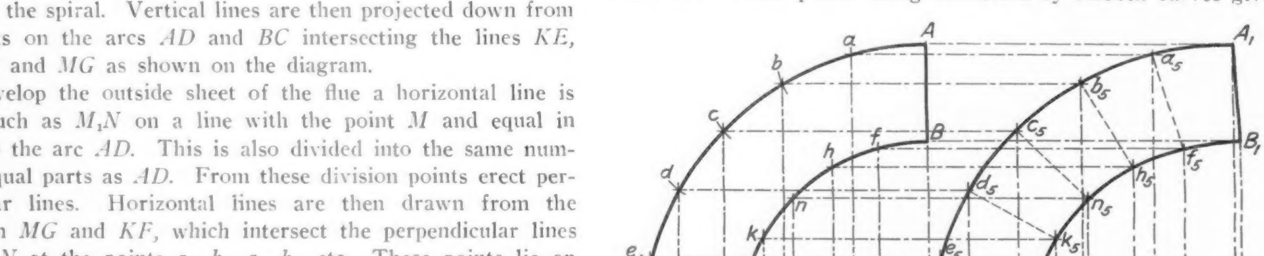
To develop the outside sheet of the flue a horizontal line is drawn such as M_1N on a line with the point *M* and equal in length to the arc *AD.* This is also divided into the same number of equal parts as *AD.* From these division points erect perpendicular lines. Horizontal lines are then drawn from the points on *MG* and *KF,* which intersect the perpendicular lines from M_1N at the points a_3, b_3, a_4, b_4, etc. These points lie on the contour of the sheet and when joined by a smooth curve give the layout of the outside sheet in its development. The development of the inside sheet is obtained in a similar manner, M_2P being the length of the arc *BC.* Perpendiculars are erected from the division points, as before, and points f_3, h_3, f_4, h_4, etc., are located by projecting horizontal lines across from *KE* and *MH.*

The top and bottom sheet have the same form, so the development of only one is necessary. The outside edge A_1D_1 is obtained by laying off D_1O_1 equal to *FK* or *MG,* carrying the division points e_1, d_1, c_1, etc., with it. Perpendicular lines are erected from these points and their intersections with the horizontal lines drawn from the corresponding points on the arc *AD,* locate the points e_5, d_5, c_5, etc., on the outside edge of the sheet. The inside edge is obtained in a similar manner, C_1O being equal to *KE* or *MH,* the points m_1, n_1, h_1, etc., being transferred to C_1O



Arrangement of Boilers and Smoke Flues.

as before. The perpendicular lines from these points are intersected by the horizontal lines from the corresponding points on arc *BC* at m_5, k_5, n_5, *etc.,* which locates points on the inner edge of this sheet. These points being connected by smooth curves give the actual form of the top and bottom sheets. In this particular case the spiral was so small that all the different sheets could be made of one piece, but where they have to be made up of several pieces sufficient lap should be allowed on each sheet to allow for riveting.



Development of Rectangular Spiral Smoke Flue.

STANDARD PRACTICE CARDS ON THE ERIE

Best Methods Outlined for Performing Different Operations or Making Repairs. Guess Work Eliminated, Improper Methods Done Away With, Untimely or Unnecessary Repairs Avoided.

BY O. S. BEYER, JR.

A system is in use on the Erie Railroad whereby those practices most universally encountered in the maintenance of equipment are standardized over the entire road, and the proper carrying out of these practices is insured. This system is known as "standard practice," and is promulgated through a book of standard practice cards. This book consists of a set of cards conveniently indexed and bound in a loose leaf binder of pocket size. One book is furnished each general officer, and each division officer of both the locomotive and car departments. The different practices which are to be followed as standard are outlined clearly and concisely on these cards, and are illustrated by sketches, if necessary. The purpose of the system is primarily what its name implies—to standardize the many practices which are daily encountered and repeated at all points where equipment is inspected and maintained. That this is desirable will appeal to every one who realizes the possibility of failure and the waste and the inefficiency existing where the various practices, which should be standardized, are carried out according to varying individual judgment and opinion.

The benefits resulting from standardized practices are many. Considered from the view point of safety in the operation of rolling equipment, they eliminate considerable guess work at times of inspection or repair. They answer many vexatious questions. Allowable limits of wear, the conditions under which to renew worn parts, the proper pressures to use when making force fits, and many other similar points are definitely settled. In the furtherance of economy they avoid unnecessary and untimely, or enforce necessary and timely repairs. They help to prevent wasteful duplication of work. From the standpoint of efficiency they outline the best methods, all things considered, for performing different operations or making certain repairs.

Owing to the extensive territory covered by a railway, the organization required to operate, maintain and supervise it is necessarily complicated. Hence it is often a matter of great difficulty for superior officers to weed out practices which should not prevail and establish the best practices. One of the greatest benefits arising from the standard practice system is the well defined channel that it opens through which correct practices may be established and enforced.

No. 1 **ERIE RAILROAD COMPANY** 9-8-09

NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—BOXES, DRIVING AND TRUCK: CLEARANCE AND MAXIMUM DISTANCE ALLOWABLE BETWEEN BOXES AND WHEEL HUBS

	Standard Clearances.	Maximum Allowable Clearances
Distance between all boxes and hubs on driving wheels, radial engine trucks and trailing trucks..	⅛" each side ¼" total	¾" total
Distance between all four-wheel engine truck boxes and wheel hubs and between all trailer boxes and wheel hubs	⅛" each side ¼" total	1" total

*Form 3154-1-12-09-200

Fig. 1—Standard Practice Card for Driving and Truck Box Clearances.

No. 18 **ERIE RAILROAD COMPANY** 12-27-10

NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—IDENTIFICATION CHART OF IRON AND STEEL.

It is required whenever a shipment of iron or steel is received, same should be placed in rack provided for that purpose and projecting end painted as per following chart, in order to identify the different grades. When only part of bar is to be used the unpainted end should be cut and by no means return part of bar to rack with identification marks removed.

SYMBOL.	TO REPRESENT.
White Disc.	No. 1 Wrought Iron, round and flat. Spec. 274, for engine bolts, motion hangers, draw bar pins and radial stays.

(OVER)

Fig. 3—Front of Standard Practice Card for Identification of Iron and Steel.

No. 2 **ERIE RAILROAD COMPANY** 3-08

CHICAGO & ERIE RAILROAD

N. Y. S. & W. RAILROAD N. J. & N. Y. RAILROAD

MECHANICAL DEPARTMENT

STANDARD TAP DRILLS—U. S. STANDARD THREAD

SIZE OF TAP	THREADS IN INCH	SIZE OF DRILL	SIZE OF TAP	THREADS IN INCH	SIZE OF DRILL
¼	20	3/16	1¼	7	1 3/32
5/16	18	¼	1⅜	6	1 3/16
⅜	16	5/16	1½	6	1 5/16
7/16	14	11/32	1⅝	5½	1 13/32
½	13	13/32	1¾	5	1½
9/16	12	15/32	1⅞	5	1⅝
⅝	11	½	2	4¼	1 23/32
¾	10	⅝	2¼	4½	1 31/32
⅞	9	¾	2½	4	2 3/16
1	8	27/32	2¾	4	2 7/16
1⅛	7	15/16	3	3½	2⅝

+Form 2050—3-08—200

Fig. 2—Standard Practice Card for Tap Drills and Threads.

Green Disc	Round Iron for stay bolts, Spec. 278.
Red Disc.	Tool Steel, Mushet, temper No. 2, for rivet snaps, roller flue expanders.
Yellow Disc.	Tool Steel, Mushet, temper No. 4, for flue beading tools, shear blades, Prosser expanders.
Blue Disc.	Tool Steel, Mushet, temper No. 4, annealed, for punches and dies, taps and reamers.
Brown Disc.	Tool Steel, Mushet, high speed, for machine cutting tools.
White Disc, Black Bar.	Tool Steel, (braeburn) machine dies, chisels and smith tools.
Red Disc, Black Bar.	Tool Steel, crucible, cast, annealed, for gauges.
Yellow Disc, Black Bar.	Machinery Steel, 35 per cent. carbon, set screws.
Brown Disc, Black Bar.	Steel, Spec. 356, crosshead and piston rod keys.

Fig. 4—Back of Standard Practice Card for Identification of Iron and Steel.

HOW ESTABLISHED.

The origination of standard practices is not the assigned duty of any one, although a competent mechanical engineer, well qualified to handle this work, has charge of the process of their adoption. To begin with, all those practices that permit of ready standardization on account of their universality and which are most apparent are taken up as fast as possible. Drafts are prepared and submitted for criticism to all the officers of the department concerned. The results of these letter-ballots are carefully considered and on the strength of them all final drafts of practices are prepared. The final drafts are then submitted to the highest officer in the department for approval. When this is received, the cards are printed and distributed.

On the other hand, if it is noticed that poor practices prevail for the accomplishment of certain objects, if repeated failures occur, instructions are issued to investigate with the object of eradicating the poor practices and establishing standard practices in their place. The investigation is made, and as a result a draft is prepared of the proper practice which should be followed. The recommendation then goes through the same process of adoption as described above. In general, every one is encouraged to make suggestions. They are always given careful consideration, and, if the practices recommended are of sufficient importance and universality to warrant adoption, they are put through the regular process of establishment. An endeavor is thus made to arouse the interest of every one.

No. 41 **ERIE RAILROAD COMPANY** 2-23-09

N. Y., S. & W. RAILROAD N. J. & N. Y. RAILROAD
CHICAGO & ERIE R. R.

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—CYLINDER HEADS

When cylinder heads are machined, the joints should be corrugated and weakening grooves cut in the studs and heads.

REFERENCES: Sketch on reverse side and card No. 8024.
Individual drawings of cylinder heads.

GENERAL PRACTICE:—Roundhouse and Back Shop.

Form 3184-2-09-200

Fig. 5—Front of Standard Practice Card for Cylinder Heads.

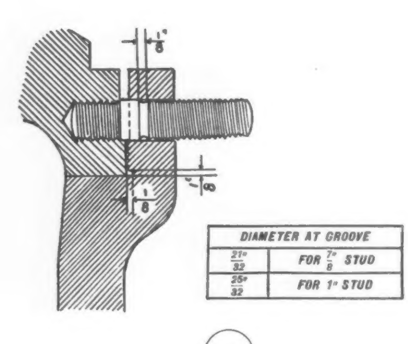


Fig. 6—Back of Standard Practice Card for Cylinder Heads.

44-B **ERIE RAILROAD COMPANY** 3-16-11

NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—PAINTING, CLASS A, OUTSIDE, FOR PASSENGER, MAIL, BAGGAGE AND EXPRESS CARS

Car to be primed with lead and oil primer; when dry, putty all holes and rough places; knife in all open grain wood; sandpaper and apply two coats standard body color ground in oil; letter on this with two coats medium chrome yellow in oil. Roof-boards to receive one coat freight paint No. 5; when dry apply canvas previously painted on under side; after being applied finish with three coats paint No. 5. Platforms and steps primed with same car primer and finished with two coats truck enamel. Outside of trucks to receive body primer in oil and puttied up and finished with two coats of truck enamel. Inside of truck to be painted with one coat of freight car paint No. 5.

Edge of roof, truss rods, hand rails, &c., to receive one coat black paint. All blind ends to receive two coats sand on priming coats; stencilling to be applied to trucks as per blueprint.

Fig. 7—Standard Practice for Painting Outside of Passenger Cars.

No. 47-B **ERIE RAILROAD COMPANY** 6-16-10

NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—CLEANING INTERIOR OF REFRIGERATOR CARS (IN SERVICE)

Floor and walls to be thoroughly swept off and condition of surface noted. If soap and water is required to clean, use Erie standard soft soap, diluted. If surface is not in need of soap cleaning, scrub with the car cleaner and wipe thoroughly dry. (The interior finish should be preserved as much as possible at all times, and avoid using a strong solution when it is unnecessary.)

The floor should be scrubbed with the same soap in full strength, rinsed with warm water, and mopped dry.

Fig. 8—Cleaning the Interior of Refrigerator Cars.

No. 72. **ERIE RAILROAD COMPANY** 6-1-09

N. Y., S. & W. RAILROAD N. J. & N. Y. RAILROAD
CHICAGO & ERIE R. R.

MECHANICAL DEPARTMENT

STANDARD PRACTICE: Use the Following Pressures for Forcing in Axles and Crank Pins into Cast Iron and Steel Wheel Centers:

DESCRIPTION	DIAM. OF FIT INCHES	TONS PRESSURE C. I. WHEEL CENTER	STEEL WHEEL CENTER
Driving Axles	4½"	45 to 50	72 to 80
" "	5"	50 to 55	80 to 88
" "	5½"	55 to 60	88 to 96
" "	6"	60 to 65	96 to 104
" "	6½"	65 to 70	104 to 112
" "	7"	70 to 75	112 to 120
" "	7½"	75 to 80	120 to 128
" "	8"	80 to 85	128 to 136
" "	8½"	85 to 90	136 to 144
" "	9"	90 to 95	144 to 152
" "	9½"	95 to 100	152 to 160
" "	10"	100 to 105	160 to 168

Fig. 9—Standard Practice for Force Fits.

Eng-Truck Axles	3½"	20 to 25	30 to 37
" "	4"	25 to 30	37 to 45
" "	4½"	30 to 35	45 to 52
" "	5"	35 to 40	52 to 60
" "	5½"	40 to 45	60 to 67
" "	6"	45 to 50	67 to 75
" "	6½"	50 to 55	75 to 82
" "	7"	55 to 60	82 to 90
Car and Tender Truck Axle	4"	20 to 25	30 to 37
" " " " "	4½"	25 to 30	37 to 45
" " " " "	5"	30 to 35	45 to 52
" " " " "	5½"	35 to 40	52 to 60
" " " " "	6"	40 to 45	60 to 67
" " " " "	6½"	45 to 50	67 to 75
" " " " "	7"	50 to 55	75 to 82
Crank Pins	3"	15 to 20	24 to 32
" "	3½"	20 to 25	32 to 40
" "	4"	25 to 30	40 to 48
" "	4½"	30 to 35	48 to 56

Sheet No. 1. Form 3184-5-09-200

Fig. 10—Standard Practice for Force Fits.

HOW USED.

When the division master mechanic receives a card outlining a new standard practice, he takes it up as a subject for consideration and discussion at the next staff meeting of his subordinate officers. The new standardized practice is then carefully explained, questions are raised and answered in regard to it and its application is thoroughly discussed. The individual foremen, who will be held responsible for carrying out the instructions, make a copy of the card in their personal note books. They then go out and instruct the men whom they supervise in the use of the new practice. It has been found that these men take such an interest in the cards that during their leisure time they go into the office of the general foreman, where the cards are kept permanently, and make a copy of them. The foreman is held directly responsible for the carrying out of the standard practices by the general foreman and the master mechanic. He is checked up continually by his superiors and by the assistant to the general foreman, whose duty it is in part to see that standards are properly maintained. It has been found that this plan is very successful and that the various established practices are conscientiously followed.

Another channel through which standard practices are thoroughly engrained is in the apprentice instruction. The apprentices are taught the use of these cards by both the school instructor and the practical instructor, and are encouraged to copy them for their own immediate and handy reference.

No. 72 **ERIE RAILROAD COMPANY** 4-1-09

N. Y., S. & W. RAILROAD N. J. & N. Y. RAILROAD
CHICAGO & ERIE R. R.

MECHANICAL DEPARTMENT

STANDARD PRACTICE: Use the Following Pressures for Forcing in Axles and Crank Pins into Cast Iron and Steel Wheel Centers:

DESCRIPTION	DIAM. OF FIT INCHES	TONS C. I. WHEEL CENTER	PRESSURE STEEL WHEEL CENTER
Crank Pins	5"	35 to 40	56 to 64
" "	5½"	40 to 45	64 to 72
" "	6"	45 to 50	72 to 80
" "	6½"	50 to 55	80 to 88
" "	7"	55 to 60	88 to 96
" "	7½"	60 to 65	96 to 104
" "	8"	65 to 70	104 to 112
" "	8½"	70 to 75	112 to 120
Rolled and Forged Steel Wheels 5" x 9" Journals	6¼"		55 to 60
Rolled and Forged Steel Wheels 5" x 9" Journals	6 5/16"		58 to 63

Fig. 11—Standard Practice for Force Fits.

Rolled and Forged Steel Wheels 5" x 9" Journals	6⅜"		60 to 65
Rolled and Forged Steel Wheels 5" x 9" Journals	6 7/16"		63 to 68
Rolled and Forged Steel Wheels 5" x 9" Journals	6½"		65 to 70
Rolled and Forged Steel Wheels with 5½" x 10" Journals	6⅝"		70 to 75
Rolled and Forged Steel Wheels with 5½" x 10" Journals	6 11/16"		75 to 80
Rolled and Forged Steel Wheels with 5½" x 10" Journals	6¾"		76 to 81
Rolled and Forged Steel Wheels with 5½" x 10" Journals	6 13/16"		78 to 83
Rolled and Forged Steel Wheels with 5½" x 10" Journals	7"		81 to 86

Sheet No. 2. +Form 2154—5-09—200

Fig. 12—Standard Practice for Force Fits.

No. 108 **ERIE RAILROAD COMPANY** 3-8-10

NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—FLUE SETTING

FIREBOX END

(1) All burrs and scale to be removed from flue holes, back and front sheet and if holes are more than 1-32" out of round, must be reamed true.

(2) Copper ferrule .075 M.M. gauge and ⅛" wider than the thickness of the sheet to be fastened in back flue sheet with sectional expanders; ferrule to be flush with the sheet on the fire side.

(3) Flue to be swaged to proper size and scale either filed or ground off of same, applied and driven through the sheet 3-16" and rolled tight with standard roller expanders.

*Form 2154-108—6-10—300 OVER

Fig. 13—Front of Standard Practice Card for Flue Setting.

(4) Flue to be belled with Standard Spreading Tool, Card 6222, then prosser expanded with Standard Prosser.

(5) Flue to be beaded with Standard Beading Tool No. 1.

FRONT END

(6) Front end of flues to be opened to fit holes in front flue sheet with tool provided for that purpose (See Card No. 3, Book of Special Devices) except when flues are applied without the removal of steam pipes, at which time flues will be opened after being applied to boiler. Flues to be rolled with air motor and Standard Roller Expanders and beaded with Standard Beading Tools.

Fig. 14—Back of Standard Practice Card for Flue Setting.

No. 128 **ERIE RAILROAD COMPANY** 5-2-10

NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD

MECHANICAL DEPARTMENT

STANDARD PRACTICE:—RELAYING OLD WINSLOW INSIDE ROOFS, CLASSES Z & V.

In repairing these box car roofs where sheets are otherwise good, except cracked at ridge, apply a strip of rubberoid paper 20" wide, full length of car roof. This paper to go under the roof board longitudinal strips. After roof boards are nailed down, apply another strip of rubberoid paper 20" wide on top of roof boards, and under the running board saddles, nailing same with ¾" nails and tin washers about 3½" centers. Tighten up all bolts and solder all holes there may be in roof sheets (except at ridge). Where roof boards are good, indicating recent repairs, apply one strip of rubberoid paper under the running board saddles if leaks exist. Winslow caps that contain numerous holes should be renewed, rather than expend much money soldering up the same.

REFERENCE. Sketch on Back.

Fig. 15—A Standard Practice Card for the Car Department.

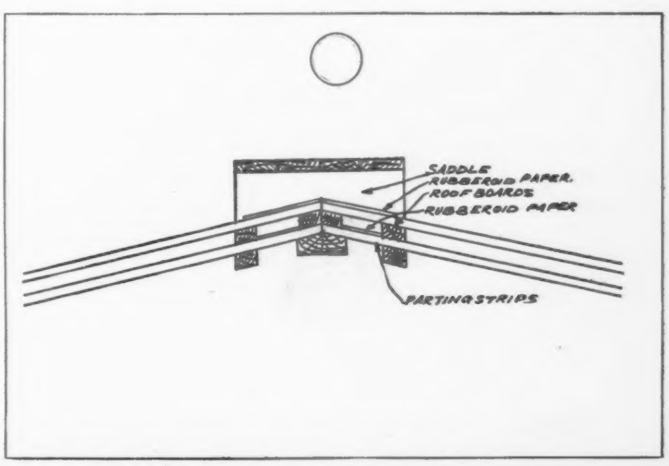


Fig. 16—Back of Card Shown in Fig. 15.

It has been found that they are of great value in the design of new equipment. Many are incorporated in new designs and specifications, with the result that the maintenance of the new equipment conforms to the practices which are already more or less universal over the entire road, thus preventing, to a certain extent, increased expense for maintenance.

EXAMPLES.

The wide range of practices which may be covered by these cards is shown by the accompanying illustrations. The cards are 4 in. x 6 in. in size, and where necessary are printed on both sides. The purpose of the card shown in Fig. 1 is obvious. It leaves no question in regard to the clearances which should be maintained between driving and truck boxes and the wheel hubs, and those which should not be exceeded.

The card shown in Fig. 2 settles once and for all the proper system of threads to be used on the entire road. It is also a handy reference for the correct sizes of drills to be used in connection with drilling and tapping holes for particular size studs, etc. Ordinarily the determination of the right sizes to use is often a matter of guess work, with the result that a good deal of drill and tap work is either done imperfectly or is spoiled.

The value gained by following out the practice shown in Figs. 3 and 4 must appeal to any one who realizes the mix-ups that result at iron racks where no system, or a loose system of material identification is employed. Valuable time is saved by men who are required to select material from the rack. Furthermore, the card designates the various uses to which the different irons and steels are to be put. It answers many troublesome questions, and also insures the correct employment of the different steels in the manufacture of tools, gages, screws, keys, etc.

A good example of a practice which might vary greatly according to individual opinions, or perhaps not be observed at all, if it were not standardized, is shown by the standard practice card for cylinders, Figs. 5 and 6.

The painting of equipment is another practice which will vary according to individual experience and judgment. The standard practice shown in Fig. 7 is the best that could be devised as a result of the experience and judgment of all those best qualified to advise in regard to it.

This standard practice for cleaning the interior of refrigerator cars in service, as shown by the card in Fig. 8, typifies to what extent the cards may be employed. Another example of a practice which should be identical at every place where force fits are made is shown by Figs. 9, 10 11 and 12. It insures against failure on the one hand, and is a check in connection with the gage records, if subsequent failures do occur.

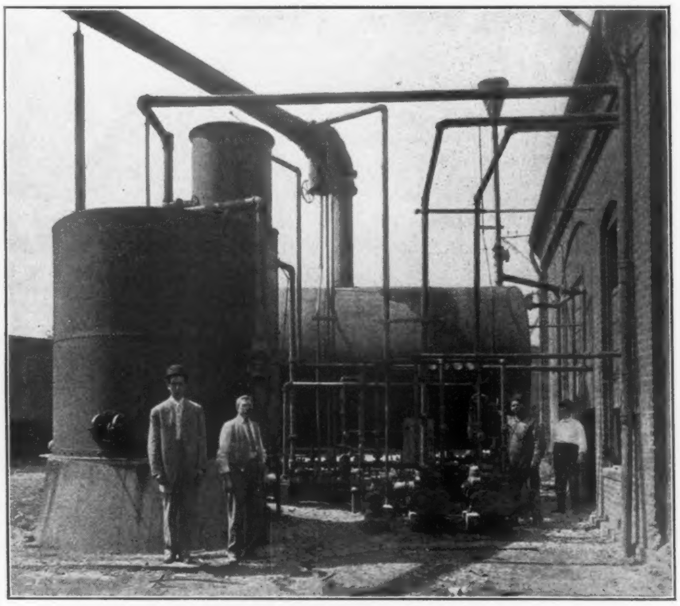
The standard practice cards for flue setting shown in Figs. 13 and 14 indicates how standard practices may be of assistance to the apprentices. It is also the basis on which prices for flue setting are made. A good example of the application of standard practice in the repair of cars is shown by Figs. 15 and 16, which describe and illustrate the proper method of relaying certain classes of old Winslow inside roofs.

LOCOMOTIVE DEVELOPMENT IN ITALY.—For some years the most notable locomotive designs in Italy have been four-cylinder compounds of the 2-6-2 and the 0-10-0 types, and two-cylinder compounds of the 2-6-0, 4-6-0 and the 4-8-0 types. Lately, however, the Schmidt superheater has come into favor, and the tendency is to go back to the simple engines with lower boiler pressures. One of the recent interesting designs is that of a four-cylinder simple Pacific type weighing 192,600 lbs., with 116,500 lbs. on drivers. The cylinders are 18 x 27¼ in.; the boiler pressure is 170 lbs.; the grate area, 37.8 sq. ft.; the superheating surface, 723 sq. ft., and the total equivalent heating surface, 3,351 sq. ft. By using the superheater the boiler pressures have been reduced as much as 65 lbs.

BOILER WASHING SYSTEM.

As an addition to the former equipment of the Richmond enginehouse, the Richmond, Fredericksburg & Potomac has installed a hot water boiler washing and refilling system, designed and erected by the Horace L. Winslow Co., Chicago. This apparatus, which is shown in the accompanying illustration, differs in a number of particulars from previous systems of this kind, and after a service of two or three months is reported by those in charge to be satisfactory in every way. It has been found that any desired temperature of the washout water can be obtained up to the boiling point, but that 140 deg. is as hot as can be comfortably handled. The washout water is usually much too hot as it comes from the tanks, and it is necessary to inject cold water to hold the temperature down. No difficulty has been found in keeping the tank of filling water at a temperature of 212 without the addition of heat from an outside source.

Although up to the present time the system has not been called upon to handle more than three engines at one time, it has been found that with one engine being blown down, another filling and a third being washed out, all at the same time, thoroughly



Boiler Washing and Refilling System.

satisfactory temperatures and supplies are available. It is also reported that since the installation of this system, there has been a time saving of about 75 per cent. in the lay-over of engines at the washout points.

This system is designed on what is known as the two unit system, consisting of a combination receiver and separator and a heater with the accompanying pumps, thermostat, purifier, etc. The system as installed at Richmond has a capacity of about 15,000 gal. of water in the heater tank, sufficient to fill two locomotives at 212 deg., and when mixed with sufficient water to give a temperature of 140 deg. will also furnish a sufficient supply for washing out two more locomotives.

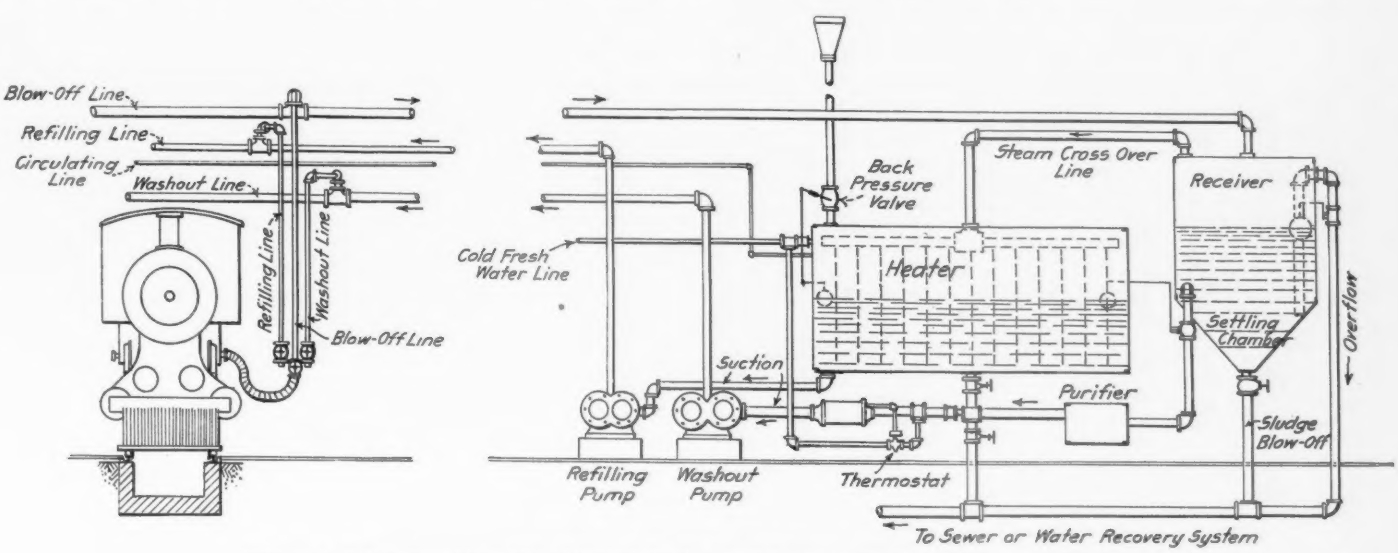
In operation, connection is made between the blow-off valve of the locomotive and one of the lines connecting each pit to the blow-off main around the house. These connecting lines are each protected against back flow from the main by a check valve and a gate valve. The water, scale and sludge which is blown off is carried through the main and discharged to the tank marked "receiver" in the illustration. After the main becomes heated up, most of the water which is being blown off will turn to steam upon reaching the receiver and a pressure is developed in this tank sufficient to send the steam through the cross-over line to the heater and through the series of small pipes reaching

down into the water of the heater, from which it emerges and is condensed, heating the water in this tank. The sludge, scale and such water as is condensed in the line remains in the receiving tank, which is of sufficient capacity to hold it under ordinary conditions.

If the water in the heater rises above 212 deg. and does not condense the steam, a slight pressure is developed in this tank which opens a back pressure valve and admits cold water to the tank until the pressure is entirely relieved, thus automatically holding the water in the tank at about 212 deg. If the supply of water in the heater becomes too low, a float valve opens a connection to the receiver; the water from that source, however, passed through a purifier before reaching the heater tank into which it flows by gravity. The scale and sediment carried into the receiver will very largely settle to the bottom below the outlet connecting with the purifier and is washed out by simply opening a 6 in. valve in the line connecting with the sewer; this is done about once a day. Whatever sediment may escape settling to the bottom of the receiver will pass to the inlet chamber of the purifier. Here it is permanently arrested from passing into the heater and may be washed out by opening a 3 in. valve connecting with the sewer. After cleaning the receiver and purifier some water is pumped into it backwards through the purifier, which will cleanse the purifier and make it possible to run much longer without renewal of the filtering material.

Two pumps are provided, one for refilling and one for washing out. The refilling pump takes its supply direct from the heater tank and discharges direct to the filling line without other connections. The washout pump takes its main supply from the heater tank and also from the regular cold water system in sufficient quantities to give the desired temperature for washing out. The pump discharges to the washout line direct. An examination of the illustration showing the arrangement of the piping will indicate the various connections.

A concrete water conserving and filtering reservoir was installed as an auxiliary to the boiler washing and refilling system. This reservoir is constructed underground and consists of a cylindrical and a lower conical portion, the latter containing the filter bed. When washing out the locomotives the water drains into the pit and thence through the sewer into this reservoir. This water is conducted into the chamber in the conical section below the filter bed and rises through it into the cylindrical portion, where it appears as clean, filtered water available for further use in washing out or refilling. A centrifugal pump is installed with double suction and discharge pipes, properly valved in order that, at the necessary intervals, it may be employed in pumping out the sludge from the sludge chamber under the filter bed, as well as for delivering the clean water to the heater or direct to refilling line. By means of an automatic starting switch actuated by a float in the heater, the motor operating the centrifugal pump is started or stopped as the maximum and minimum water levels in the heater are attained. The two valves located in the suction pipes below the water level are equipped with extended stems with wheels above the reservoir top. A 24 in. manhole is provided both in the reservoir top and through the filter bed and filter floor, rendering all parts easily accessible for examination or repairs. The reservoir has a capacity for thoroughly filtering and cleansing all the water coming from two locomotives which may be washed at one time.



Winslow Boiler Washing and Refilling System; Richmond, Fredericksburg & Potomac.

TERMINAL BRAKE TESTING.*

BY F. B. FARMER.

As we seek efficient train brakes and as the standard set by law is based on the train, it is obvious that terminal brake tests of trains must be made. Stated differently, the requirements can not be met by confining inspecting, testing and repairing to shops and repair tracks. Consideration of overtime and the sixteen-hour law, as well as expeditious train movement demand the minimum lapse of time between that for which the crew is called and the time the train departs. Hence, a train prepared for departure should require no more brake work after the engine is coupled than, at the most, stopping a few leaks in hose couplings and making the formal test. But often there are greater delays due to making other repairs, or the train proceeds with less efficient brakes than it should have. To avoid this, the repairs required must be determined with arriving trains. The incoming engineer should add to the reduction required for stopping enough to fully apply the brakes, and the brakeman should await his advice that this has been done before cutting off the engine. Car inspectors should be present to make an immediate examination and to bad order all defective brakes. Such repairs as ordinary brake pipe leaks, defective hose and wrong piston travel, which require little time, should be made, but cars requiring heavy brake repairs should be marked for the repair tracks.

Here is where judgment must be exercised, as perishable or other very important loads, as well as empties needed at once for such lading, must not be delayed. Neither should other less important cars be held in numbers far greater than the local force

*Abstract of a paper read at the December meeting of the Western Railway Club, Chicago. Mr. Farmer is a representative of the Westinghouse Air Brake Company.

can repair in a day if such force is as great as the regular amount of work, including such repairs, would keep busy. The car foreman and the yard master should consult to adjust this, but when the former removes bad order marks without repairs having been made, he should fill out and apply an air brake defect card to better insure prompt repairs at the earliest practicable date. However, it does not follow that the repairing of defective brakes cannot be done without delay to cars which should go forward promptly. The Minneapolis, St. Paul & Sault Ste. Marie has largely solved this problem at an important terminal yard by assigning a short track in the yard for air brake repairs to such cars. With a few men and the necessary repair materials, such cars are often ready for the first train out, are never actually delayed, and few are allowed to go forward without repairs. This is but one detail of a very comprehensive scheme of improvement in freight brake maintenance effected by this road.

As one repair point on a large system cannot maintain all freight car brakes, it is obvious that each terminal should do its share, but this does not mean that other than the outgoing test should be made on through trains at the points with small facilities. A brake well repaired will go for a long period without becoming defective, but the too common failure to do so is due to inadequate repairs. To reduce the cost of brake cleaning by leaving cylinders and auxiliary reservoirs loose on the car is to insure leaky pipes. The same result follows if the brake pipe and retaining valve pipe are not well secured. That most serious fault, brake cylinder leakage, will develop sooner than it should, sometimes immediately after the cleaning, unless a suitable lubricant is employed and packing leathers are replaced when a good inspection and a careful test would show that they should be. The practice often followed of cleaning and testing triple valves on the cars cannot insure good work. Neither is it common practice to test hose with soap suds while under maximum pressure and remove those found porous, or to examine the retaining valve weight and clean the case and small vent port. Until these and other details are given better attention in shops and on repair tracks, it will not be possible to effect the economy in time and money in terminal brake testing and the consequent repairs that will otherwise follow.

The M. C. B. requirement that cars in interchange must have retaining valves should imply the maintenance of this part and its pipe by the owning road. It is not sufficient to say that the mountain road may make needed repairs at the owners expense, as this means undue delay to traffic. However, inspections show that the average efficiency of brakes is otherwise much lower on the cars of level grade roads, a condition for which there is no warrant as that for the average mountain grade road is enough below 100 per cent. efficiency to justify making it the minimum.

That the regular terminal test of freight train brakes misses many of the defects which nullify the object sought in attaching air brakes, is conclusively demonstrated by the following: Within a few months competent parties made a test on several freight trains at the summit of a mountain grade, following a similar test by regular inspectors at the preceding division terminal, and out of which trains bound down this grade were supposed to leave with 100 per cent. efficient brakes, based on such test. The tests consisted of charging to 70 lbs., making a service reduction of 15 lbs. and rapidly examining for any brakes failing to apply or leaking off and incorrect piston travel. To show conclusively the oversights of the ordinary terminal brake test the infallible thermal brake test was made on each train at the foot of the grade. The customary plan was there followed of considering three cars with "warm" wheels equal to one with "normal" wheels; that is with a good brake. In addition to showing the results in percentage, they are given in "tons per good brake," derived by dividing the train tonnage by the number of good brakes.

The first train was a test train and had 2,501 tons. The other six were regular trains and ran from 2,252 to 2,367 tons, averaging 2,286 tons. Each train had a considerable percentage of foreign cars. No tests of or repairs to retaining valves were made.

Per Cent. Good Brakes by Test.		Tons per Good Brake by Test.		
Standing.	Thermal.	Standing.	Thermal.	Cars per Train.
97.7	68.8	42.6	59.5	61
91.0	75.0	45.0	54.6	56
100.0	60.0	40.7	67.6	58
98.1	53.7	42.5	77.6	54
98.1	52.8	43.8	81.5	53
96.4	53.5	41.7	75.0	56
88.9	67.2	46.2	61.2	55

The big returns from good brakes are mainly concealed, consisting of the more expeditious train movement they make possible and the avoidance of accidents, neither of which can ordinarily be shown in dollars and cents. Their observable expenses, consisting of initial cost, maintenance, flat and cracked wheels and delays to cars and trains for brake testing and repairs, are so readily seen and tabulated as to generally render even more obscure their great but intangible credit account. The pressing need is for a more accurate and practical appreciation of the fact that good brake maintenance is economy and for better directed efforts toward improved brake maintenance with a minimum increase in time and money spent. In this the active cooperation of the yard master and the superintendent will aid greatly. Too often their efforts are directed toward showing why trains cannot be held or switching done for brake work, rather than how to accomplish the desired results with the least delay or additional switching.

While there is no question concerning the imperative need of available air pressure in car shops and on repair tracks, it is debatable as to whether it pays to pipe yards. I believe that usually it does not. If locomotives have insufficient air compressor capacity to charge their trains without material delay, they are not prepared to handle the trains safely, economically and expeditiously between terminals. Following the plan of having the brake test on incoming trains, and subsequent disposition of cars with defective brakes, will leave little need for a yard air test plant. The only safe or available time for inspectors to work on cars in yards is for a limited period after the arrival of trains and again following attachment of the outgoing locomotive.

A grave evil with many air brake test plants is the excessive amount of moisture. The ground cocks in their piping are commonly referred to as "hydrants." This should be a misnomer as it means a cock for controlling the flow of water, but it is too often quite applicable. As a brake pipe obstructed by ice is even more dangerous than an accidentally or maliciously closed angle cock (the forces cannot be seen), it is enough to say that water in test plant pipes may bring about frozen brake pipes. Triple valve and brake cylinder leakage from ice are other evils which follow. Also moisture causes corrosion of brake pipes and the rust clogs strainers and feed grooves and drys up the lubrication in triple valves and brake cylinders. The cause of water in the piping is the result of insufficient cooling of the air between the compressor and the storage reservoirs, often magnified by the inadequate number and location of such reservoirs. It is many years since the Air Brake Association investigated the same fault with locomotives and though the difficulties in the way of obtaining dry air for the brakes is there incomparably greater, solved it satisfactorily. However, it should be said in passing that many locomotives, even new ones, are not properly equipped and are a source of similar damage and danger. Questioning men using air test plants will soon disclose whether such furnish dry air, whether opening a cock will show visible moisture or moisten a surface against which the air is directed. If so, it is obvious that the remedy should be applied promptly. I venture the assertion that in comparatively few cases dry air, that free from visible moisture, is available.

In seeking means for testing and repairing air brakes without loss of time in transit, extra switching, or danger to workmen

the possibilities of the freight house tracks should always be investigated. Where the number of cars per day is considerable there is no doubt that the tracks should be supplied with compressed air and full advantage taken of this excellent opportunity for locating and remedying air brake defects. In line with this idea of conserving time and switching, it is recommended that all cars in shops or on repair tracks, and having cleaning dates over nine months old, should have their brakes cleaned and lubricated. Not only will the condition of the triple valve and brake cylinders fully warrant doing this work then, but it is improbable that such cars will again be so favorably located for many months, without causing delay and switching.

FREIGHT CAR PAINTING.*

BY T. J. HUTCHINSON,

Master Painter, Grand Trunk, London, Ontario.

Painting is given the last consideration in the general maintenance of freight equipment. This accounts for the delapidated appearance of so many cars. Freight cars are seldom shopped on account of paint conditions unless the lettering is entirely obliterated. This is easily understood, for the condition of the paint on a car does not necessarily interfere with its earning capacity. This being the fact, the master painter must co-operate with the traffic department. Scarcity of cars at certain seasons of the year and the imperative traffic demands of recent years have precluded the consideration of a rigid paint formula in maintaining this class of equipment, which means that the durability of the coating is not as important as the immediate use of the car, for the reason that in most cases a car will earn, in one day several times the cost of painting it. Competition demands that the master painter who keeps abreast of the times must be "on the spot and deliver the goods." The question arises, do substitute paint oils, turpentine and benzine, now so generally used in freight car paints, give the requisite durability to the paint structure?

If this question were asked today of the most eminent chemist or practical painter of the old school, outside the range of the modern railway paint shop, they, knowing that the life of any coating depended to a great extent on the kind and quality of the vehicle used, would unhesitatingly answer, "No," and would proceed at once to make comparisons as to the cost and probable durability of the substitutes, with that of the old time tried linseed oil and spirits of turpentine, never dreaming for an instant that the greatest durability would not be an essential in the coating under present conditions of railway freight traffic. They would be entirely unable to understand how any conditions of traffic could displace either of the old reliables with the more volatile shorter lived substitutes. Durability is a consideration but not an essential. I do not wish to be misunderstood in this. Although I am of the old school and regret the passing of the old system, I recognize the necessity of sacrificing durability so that the work may be done more quickly.

The suggestion to use a substitute for linseed oil would have been met with scorn a few years ago, yet today there is not a railway paint shop in the country that is not obliged to add quick drying japans and volatile substitute turpentines to thin and hasten the drying quality of linseed oil. The qualities of linseed oil are unquestionable, but where linseed oil is made to dry equally as fast as its substitutes, I fail to see the difference in the quality of the two materials.

Railway service is the most severe test that can be given any coating, and time or service tests are the most reliable and are the painters' guide. Experience justified us in recommending those paint pigments that have been in general use for many years, because they have proved to be the most acceptable as to cost, durability and color. Therefore, with the exception of refrigerator and tank cars and other steel cars we are safe in accepting the oxide of iron pigment as the standard. The durability of any coating depends largely on the use and abuse of the cars, particularly in the destructive coal and iron traffic. Immunity from abrasion is not to be expected in this service, as time has proved that the construction of all hopper bottom cars makes a certain amount of abuse unavoidable, the greatest damage being done by the use of the mauls in unloading the cars during the winter season. Much of the damage done to the coating on the metal might be avoided by bolting short pieces of plank over the parts usually hammered and applying a stencil to this effect; "When necessary to use mauls strike here."

The initial painting of freight equipment is the all-important one. At this time all roofs should receive particular attention by the painter, for in this, as in everything else, the permanency of the structure depends on the foundation. All roofing material should be kept in stock, thoroughly primed and ready to be used by the builder when required. This would greatly prolong the life of all freight car roofs and reduce the number of claims for damage to merchandise through defective roofs. As all of our freight equipment is painted by the piecework plan, we have found it advantageous, both to the carpenter and the painter, to keep an advance supply of such staple material as car roof sheathing and flat car sills primed in the stick. This work is done by piling the sheathing on the floor, where the color is applied with the long-handled brush, removing each layer, when coated, to a wall rack to dry. We arrange to paint our supply of flat car sills in the same manner in the wood shop. This arrangement greatly facilitates the regular output of both the shop and the yard, adding much to the appearance and durability of the work when completed.

Painting new or old freight equipment expeditiously and economically depends largely on the method of doing the work, the shop temperature and the necessary shop and yard facilities. There are three methods to consider: The small short hand brush, the pneumatic paint spraying apparatus and the long handled brush. The small hand brush, except for touching up purposes, has long since been abandoned, as it is too slow to be profitable. The use of the atomizer or paint spraying machine, although having much to commend it for use out of doors, or on inaccessible parts of the under structure of trucks, etc., has not proved acceptable in the majority of shops, for the reason that because of irregular air pressure it cannot be properly adjusted to give an even distribution of the paint, and it often fills the air with atomized color much to the discomfort of the men, as well as menacing their health. On flat surfaces, such as the bodies of box cars, an even distribution of color is a necessity, and this can be most effectually obtained by the use of the long handle brush. Comparing the cost of this application with that of the sprayer, as reported in papers at conventions, we prefer the use of the brush. If good results are to be desired the temperature of the shop must be at least 60 deg. during the winter months. Not more than one coat should be applied in twenty-four hours, particularly in the northern section of the country.

Preparatory to painting the steel car it is necessary to remove all the rust possible by the use of scrapers, wire brushes and the sand blast, if available. Inert carbon blacks have proved the most durable for all metal structures for out of door use. Their many excellent qualities when the color is not objectionable, commend them for use on other classes of freight equipment. There is a limit to substitutes and a legitimate use of them. Substitutes for oil color cannot be used with impunity on metal structures. To illustrate, the following formula was obtained by the writer as the coating that was being used during the summer months on the steel coal cars of one of the largest railway systems. But when too

*Entered in the *Railway Age Gazette* competition on Paint Shop Practice which closed November 15, 1911.

cold it had to be abandoned for the regular oil black generally used:

Coal tar	8 parts
Kerosene oil	1 part
Portland cement	1 part

Portland cement with water is valuable as a vehicle for many purposes, but the difficulties one encounters in endeavoring to apply it along with paint or tar has prevented it from being used extensively. As a pigment in a mixed paint it has proved a failure, because it settles and hardens in the bottom of the pail, and when used with tar has to be added just before application. The only virtue, if any, in the above mixture as a coating for the steel car, would be in the oil which would aid a more even application of the tar, but ultimately this coating would be very brittle and would break down rapidly. When lettering, a coat of shellac must be applied to help it to dry and to prevent the discoloration of the white lead by the tar. The use of the shellac causes "alligatoring" of the surface.

SHOP KINKS*

BY E. L. DUDLEY
Special Apprentice, Baltimore & Ohio, Cleveland, O.

CHUCK FOR BORING ROD PACKING.

A chuck *A*, for boring rod packing, together with its different bushings, is shown in Fig. 1. It is made to hold nine different sizes of piston rod and valve stem packing. The chuck will fit the spindle of an ordinary lathe and is arranged in steps, as shown, to take the different sizes of packing. The cap *B* screws on the outside of the chuck and holds the packing rigidly in its cup. The packing is placed in the cups as shown at *C, D, F, K, M, O, S,* and *U*, which includes all the different sizes used on locomotives. Cup *C* is simply placed in the chuck and is held in place by the cap *B*. Where the packing is smaller, as in *D, F, K,* etc., a binding ring, such as *E, H, L, N,* etc., is inserted between the cup and the cap *B* to make up for the difference in size.

In the case of valve stem packing a still smaller series of steps has to be used than is provided in the chuck *A* and for this purpose the extra steps are made in an auxiliary chuck, *R*. When boring these packings this chuck *R* is placed in the main chuck, resting on the first step. The cup, such as *S*, is then placed in *R*, the binding ring *T* following. This is all held, as in the other cases, by the cap *B*, the thickness of the binding ring being such that the cap can be screwed on two or three threads before the ring bears on the packing. In the same way the packing *U* may be bored.

A standard wrench is shown at *V* which is used to remove the chuck from the spindle. A board *W* is also provided which may be placed back of the lathe to hold the rings, cups, wrench and tools. The cup and packing number is stenciled above each nail.

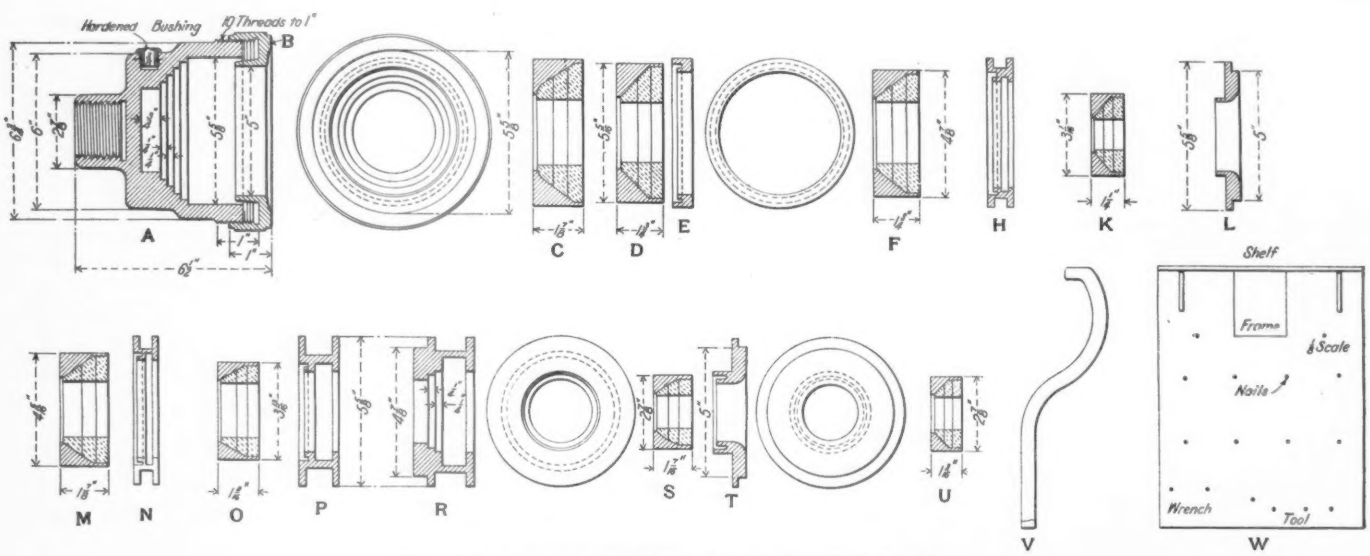


Fig. 1—Chuck and Bushings for Boring Rod Packing.

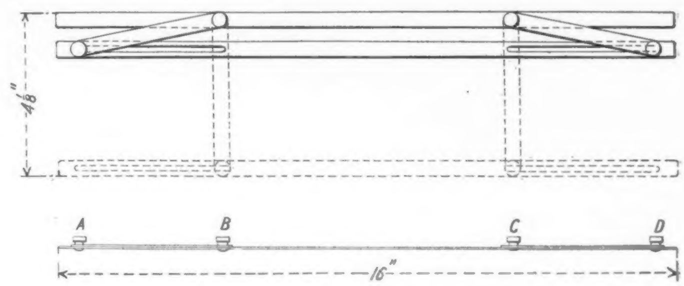


Fig. 2—Adjustable Template for Keyways.

ADJUSTABLE TEMPLET FOR KEYWAYS.

The templet shown in Fig. 2 is used to measure the size of keyways from ¾ in. to 4⅛ in. in width. It is inserted in the keyway and adjusted as to the size and taper and is held to size by the thumb screws *A, B, C,* and *D*. By the use of this templet it is found to be unnecessary to plane the keys, since the blacksmith can make the keys approximately to size and they can then be easily finished on a grinding machine.

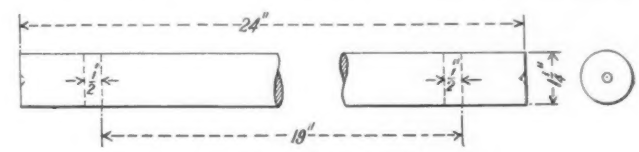


Fig. 3—Boring Bar for Bell Stand.

BORING BAR FOR BELL STAND.

A boring bar for reaming holes in bell stands is shown in Fig. 3. It has been found difficult where these holes are badly worn to get them parallel. With this bar the operation is comparatively simple. It is 1¼ in. in diameter and 24 in. long, having two ½-in. slots, for holding the tools, cut 19 in. apart, that being the distance between the two holes in the stand. The tools are held in place by wedges. The bell stand is clamped to the carriage of the lathe and the bar is put in the lathe centers. This bar can be used for the reaming tools also.

*These kinks were entered in the *Railway Age Gazette* shop kink competition which closed May 15, 1911.

Engine Failures and Their Elimination

Engine Failures Can Always Be Traced to Errors or Negligence on the Part of Individuals. Suggestions as to How to Do This and Reduce Failures to a Minimum.

By ERNEST CORDEAL
Bonus Demonstrator, Atchison, Topeka & Santa Fe, La Junta, Col.

It is not entirely accurate to use the term engine failure to announce the fact that a locomotive has not succeeded in performing the task set for it. The perfect machine kept in proper repair does not fail. The difficulty lies in that some human brain or hand has done its work imperfectly, making it impossible for the machine to perform the duty for which it was designed. When we say that an engine fails, we really mean that the designer, the builder, the official assigning the work expected of the engine, the foreman supervising its care, the workman making repairs, the inspector, or the engineman has failed to do his part, and therefore the locomotive is unable to accomplish the work that has been laid out for it. As a preliminary step toward the elimination or minimization of failures they should be traced to the individual responsible. In only a very few cases will it be found impossible to place the blame on some person or persons, and these few cases may properly be termed unavoidable failures, as they will invariably be attributable to uncontrollable conditions.

In the analysis of engine failures for a division or a system, the initial move should be to classify them into groups, localizing the responsibility on the individual as nearly as possible. Eight general heads under which all causes of failure may be divided in such a way as to devote the individual or groups of individuals responsible are as follows:

First, defective design.	*Fifth,* imperfect inspection.
Second, poor construction.	*Sixth,* incompetent handling.
Third, improper repairs.	*Seventh,* defective material.
Fourth, neglected repairs.	*Eighth,* outside causes.

Under the first head, defective design, should be placed all cases of failure by new types of power occasioned by the parts not being properly designed to stand the strain, or the service demanded of or imposed on them. In this category would be failures due to breakage, inadequacy of parts or appliances, except such as can be traced to poor construction, improper repairs, or defective material. Great care should be exercised in attributing failures to this class and no part or appliance should be condemned as ill designed until it has first been given a fair trial of ample duration to preclude the possibility of an error in judgment.

Poor construction also refers to new power, and includes such failures as are due to errors or imperfections in construction for which the builder is directly responsible. Over anxiety should not be exhibited to charge failures to either of the first two classes as it may often prove, after a sufficient test, that what at first appeared to be faults of design or construction are really only failures on the part of the operating force to thoroughly understand or properly handle power varying in detail from that to which they have been accustomed.

To the third and fourth groups, improper repairs and neglected repairs, a large percentage of the total number of failures must undoubtedly be charged. Under improper repairs should be placed all failures of parts worked on by mechanics in the period of detention immediately preceding the trip during which the failure occurred. Work performed by a mechanic which does not prove defective during the first trip and is not reported a second time by the inspector or engineman should be considered as properly done, and if failure occurs on the second or any subsequent trip, the fault should be charged against the inspector, engineman, or foreman and not against the workman.

Neglected repairs covers all failures of parts reported as defective or needing attention by the engineman or inspector and not repaired by the enginehouse force. Failure to perform work reported as necessary should always place a failure under this head regardless of the reason for its not being done. Lack of time, insufficient force, or press of other matters should not be considered sufficient excuse for raising the stigma of neglect from the head of the foreman or workman, who through carelessness or lack of judgment allows the work to go undone.

Imperfect inspection includes all failures due to a defect not reported as requiring attention previous to the trip on which the failure occurred. This should be understood to apply to all cases in which it would have been possible for the inspector to have discovered the defect in time to have prevented the failure.

Improper handling covers a class of failures which, although not as frequent of occurrence now as in the past (thanks to the present methods of educating enginemen), nevertheless sometimes happen. Under this head should be placed all failures caused by ignorance or inexperience on the part of the man running the engine. Failures in this class are generally reported as due to some minor defect which in the hands of an intelligent and experienced runner would at the worst have caused but a slight delay. The judgment of an experienced official is generally necessary before a failure should be charged to the engineer, as it often happens that an apparently insignificant defect which, at other times might not seriously affect the running of the engine, will under certain circumstances render it impossible to avoid a delay.

Any failure should be carefully investigated and considered before being placed under the head of defective material. Failures caused by broken parts when not to be accounted for by defective design, poor construction, improper handling, or outside causes may generally be included under this head, but cases will be noted where the breakage was due to improper repairs, neglected repairs, or where efficient inspection should have discovered the defect or weakness in time to have avoided a breakdown.

Under outside causes should be classed only such cases as cannot be placed under any of the preceding seven heads. Such failures as are caused by broken parts due to rough track, engines failing when the demands of traffic render it necessary to keep them in service after they have completed sufficient mileage to entitle them to a shopping, engines failing on account of being doubled over the road without sufficient intervening time to accomplish necessary repairs, and failures due to poor quality of fuel should be classed under this head. Careful investigation should precede the charging of any failure to outside causes, and no case should be considered as coming under this head which could in any way have been avoided by greater diligence or exercise of judgment on the part of any individual intrusted with the care or handling of the locomotive.

Any campaign tending toward a reduction in the frequency of engine failures should at its inception be supported by immediate and accurate reports and by brief and comprehensive records. A thorough investigation of each failure should be made immediately upon notification of its occurrence and a complete report rendered. This investigation should not be delegated to an inexperienced clerk, but should be conducted

by some person thoroughly familiar with locomotive operation and repairs and conversant with existing conditions. The report should be of standard form, showing all the required information in such a way that it may be easily understood and readily compiled into the form of a permanent and valuable comparative record. A comprehensive form for the rendition of failure reports is suggested by the accompanying Form 1.

One of these forms should be filled out, for every failure by the enginehouse at which the engine was handled just previous to the trip during which the failure occurred. The cause of the failure should not be stated in general terms such as "engine leaking," "not steaming," "blowing," or "running hot," as is common practice, but should be made as definite as possible by indicating the exact nature of the defect. In cases where the engineer is unable to specifically locate the cause of the difficulty and where such cause does not develop on subsequent inspection, the failure should be considered as one of improper handling and the enginehouse force should be cleared of any responsibility. The incorrect or generalized reporting of work by enginemen is one of the greatest difficulties with which the investigator of engine failures will have to contend unless his work has been preceded, or is being paralleled, by a course of instruction in the art of intelligently reporting work.

The cause of failure having been positively fixed, the work reports of the engineer and the inspector should be examined to determine whether or not any defect was reported previous to the failure, which might have been responsible for the breakdown. In case no report was made of the condition of the part failing, a further study of the cause should be made to settle whether or not the defect was of such a nature that a careful inspection previous to the failure should have discovered the necessity for repairs. If it is decided that the likelihood of failure should have been detected during proper inspection the responsibility should be charged against the inspector and further research is unnecessary.

ENGINE FAILURE REPORT

Date Oct. 30, 1911 Division Valley

Engine No. 1011 Group 3

Station handling Denver

Cause of failure Left main driving box running hot on account not properly packed

Work reported Pack left main driving box

Work done Left main driving box packed

Engine inspected by Smith

Work done by Jones (X)

Foreman in charge Black

Engineer Brown

Report rendered by R. S. Rich

NOTE Cross (X) should be placed after the name of person responsible when failure is classed under groups 3, 4, 5, or 6.

Action taken

Form I—Individual Engine Failure Report.

Suppose the defect to have been discovered and properly reported by either the engineer or the inspector. The next step is to ascertain from the records of work done whether or not the performance of the work in question was delegated to any workman by the foreman. In case the foreman did not issue instructions to have the work done, it is either an indication of poor judgment in deciding that the work reported was unnecessary or of neglect or oversight in not having the proper repairs made. In case the condition of the engine was properly reported and an order for the performance of the work was duly issued by the foreman to a workman the responsibility for any failure to complete the necessary repairs in a manner such as to preclude the possibility of breakdown should be placed on the individual workman, not forgetting, however, that the foreman should bear a certain amount of the blame as it was his duty to know not only that the repairs were made, but that they were properly made. Extenuating circumstances may intervene to mitigate in some degree the severity of the criticism due foremen or workmen on account of improper or neglected repairs, as in cases where insufficient time could be allowed for the proper completion of the work or where proper material was not available.

With the data secured through this investigation, the rendering of an accurate report is made possible, and if the investigator has worked with despatch a full record of the case should be in the hands of the master mechanic a few hours after the occurrence of the failure. The master mechanic, having at hand reliable information, is in a position to administer caution, censure, or discipline, as the case may require, to the individual responsible and that at a time sufficiently soon after the occurrence to lend it added weight. The placing of individual responsibility, it will be found, is one of the greatest aids in reducing failures. When it is understood by enginemen, foremen, inspectors, and workmen that each failure will be traced down until the person or persons accountable are located and that the blame will fall upon the head of the individual who has failed in his duty, the quality of the service rendered by each will be noticeably improved.

MONTHLY ENGINE FAILURE RECORD

By Stations

Station Little Division Grand Month Oct. 1911

Date	Engine Number	Cause	Group	Persons Responsible	Action Taken
1	1077	Flues leaking left side of firebox	3	H Smith	Reprimanded
4	1055	Right front frame broken back of cyl.	1		
5	1132	LB main rod brass hot	4	P Jones	Laid off
7	1148	Broken spring hanger No. 1 driver	8		
14	1220	Engineer could not make time	6	R. White	Reprimanded

Form II—Monthly Engine Failure Record.

At the end of each month the reports covering individual failures should be compiled into a record arranged in date order and showing all of the information which will be required at any subsequent time. Form II is suggested for such a record. This form shows the date of failure, cause, general head, person responsible, if any, and the action as to discipline which the master mechanic or other official saw fit to take. At the bottom of the report should be shown the total number of failures, also the total number for the previous month and for the same month of the previous year for purposes of comparison.

The arrangement of this record by stations is for the purpose of providing a simple means of comparing the quality of work performed at various periods. A copy should be sent to the foremen in charge for their personal information and another copy should be posted so as to be accessible to the workmen and enginemen. In this way the record as to the failures, whether good or bad, will be kept before the men who are directly responsible for the condition of the power. No man will care to have his name posted as responsible for the failure of an engine and as a consequence each individual workman, inspector, foreman, and engineer will exercise a greater amount of care in the performance of his part of the work.

The posting of reports for the inspection of employees gives them, to a certain degree, a feeling of co-responsibility with the officials for the attainment and maintenance of a creditable record.

It will be noticed that when the workmen are taken into confidence to the extent of letting them know how their collective performance compares with that of other points or with other periods, they will respond by evincing an added interest in the welfare of the company which employs them.

A second record of failures by divisions should be kept for the purpose of comparing the performance of various divisions during different periods. This record should be in such form as to facilitate comparison between the performance of different classes of power, showing the number of failures of each class attributable to the causes covered by the general heads, and giving the number of engine miles per failure for each individual engine and the total for each class. A suggestion for a report filling this requirement is shown in Form III. This form has a column for the class number followed by one for the number of the individual engine. The mileage per engine, number of failures, miles per failure, and number of failures coming under each of the eight general heads are shown. Totals and averages should be extended for each class of power, and at the end of the report should be given a recapitulation, showing each class separately, the grand totals, and averages for the divisions. On divisions where the pool system is not in effect, and where engineers are assigned to particular engines, the value of this record can be further enhanced by adding a column for the engineer's name. On divisions where the pool system is in effect a record may be easily compiled from Form 1 showing the failures of engines handled by each individual engineer.

The tabulation of failures by engine classes and by individual

MONTHLY FAILURE RECORD OF INDIVIDUAL ENGINES

By Divisions

Division Grand Month Oct. 1911

Class	Engine Number	Mileage	No. Failures	No. Miles Per Failure	Cause 1	2	3	4	5	6	7	8	Engineer
1000	1055	3580	2	1790	1							1	
	1077	4400	1	4400			1						
	1130	5600	0	5600									
	1132	3800	1	3800				1					
	1148	4250	3	1417					1	1		1	
Total		21630	7	3090	1	0	1	1	1	1	0	2	
2000	2001	2400	0	2400									
	2002	4650	1	4650					1				
	2003	3760	3	1253			2	1					
	2004	3890	2	1945			1					1	
	2005	4530	2	2265						1	1		
	2006	2100	1	2100			1						
	2007	4480	3	1493	1			1		1			
Total		25810	12	2151	1	0	4	2	1	2	1	1	

Form III—Monthly Failure Record of Individual Engines.

engineers will develop much interesting and valuable information. For instance it will be found that with a certain class of power a large percentage of the failures are due to some specific cause which may be remedied by a slight change of design, by the substitution of an improved type of some small appliance, or by the re-enforcement of some weak part. It will also be found that certain engineers will have a series of delays or failures attributed to some one cause, while other men running the same engines or ones of identical construction have no trouble along that line. A study of this record will develop deficiencies in the knowledge or experience of runners and render it possible to educate the individual along the line of his greatest need.

Investigating, reporting, and recording failures is of course only a preliminary step and it should not be considered when this work is done promptly and accurately that the end has been accomplished. The best reports, if made up and filed away without being given careful study, are of no more value than the poorest or none at all. In order to extract the full value from any report or record it must be carefully and intelligently studied, the points which it brings out noted, and action taken to correct improper practices and educate inexperienced workmen.

PAINT SHOP KINKS*

BY A. G. PANCOST,
Elkhart, Indiana.

RACK FOR SIGNAL BLADES.

The paint department has the care of all signal blades, repainting and cleaning them when they become dirty and smoky from use, and furnishing them for replacements or for new installations. So many blades are handled that it is necessary to have some method of storing them. The rack shown in Fig. 1, contains twenty pockets, each capable of holding ten blades, making a total of 200 blades when the rack is filled. If it were

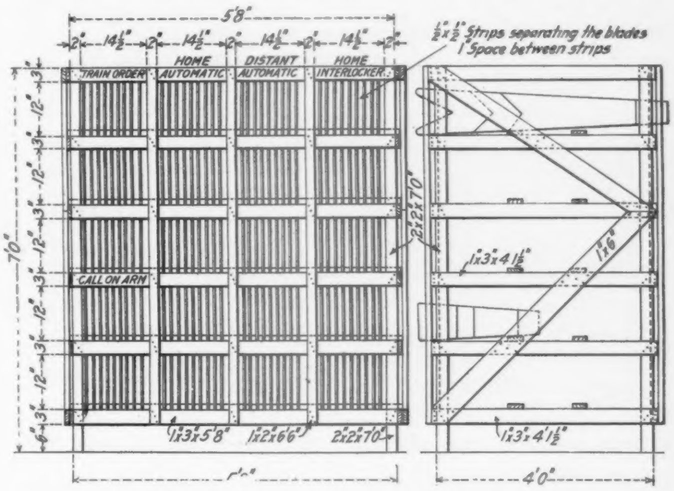


Fig. 1—Rack for Storing Painted Signal Blades.

filled with the different kinds, as indicated at the top of the rack, it would contain 50 home blades for interlocking signals, 50 each of the home and distant blades for the automatic signals, 30 train order blades and 20 call-on or short arms used on three position upper quadrant signals. The side view shows one short blade and one long blade in position in the rack. This has been found very useful, not only keeping the blades in good condition, but for classifying them so that the person in charge can determine the condition of the supply of blades almost at a glance.

EASEL FOR PAINT SHOP.

There is more or less lettering, numbering and various markings to be done in a railway paint shop on different apparatus.

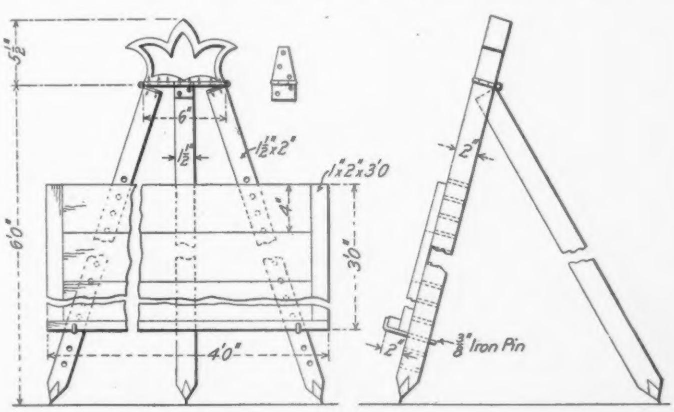


Fig. 2—Paint Shop Easel.

Any one familiar with general sign work will at once see the necessity and usefulness of possessing an easel similar to the one shown in Fig. 2. This may be spread out to accommodate most any large work, or it may be used for small work. The

*Entered in the *Railway Age Gazette* competition on Paint Shop Practice which closed November 15, 1911.

board shown resting on the easel is useful when lettering on cardboard, paper, glass or sheet metal, or in fact any material that will not readily stand alone. The holes bored at intervals of 2 in. along the uprights, allow the work to be raised or lowered as desired. The ends of the legs are equipped with metal points, which serve to hold the easel in place.

KEROSENE TANK FOR PAINT BRUSHES.

The construction and arrangement of a galvanized-iron tank in which paint brushes are kept when not in use, thus preserving their shape and elasticity, is shown in Fig. 3. Many brushes are spoiled from improper care when not in use. This receptacle has two apartments, one for brushes which have been used in light colors and the other for brushes which have been used in dark colors. Each apartment is equipped with a removable wooden rack, which may be removed when it is desired

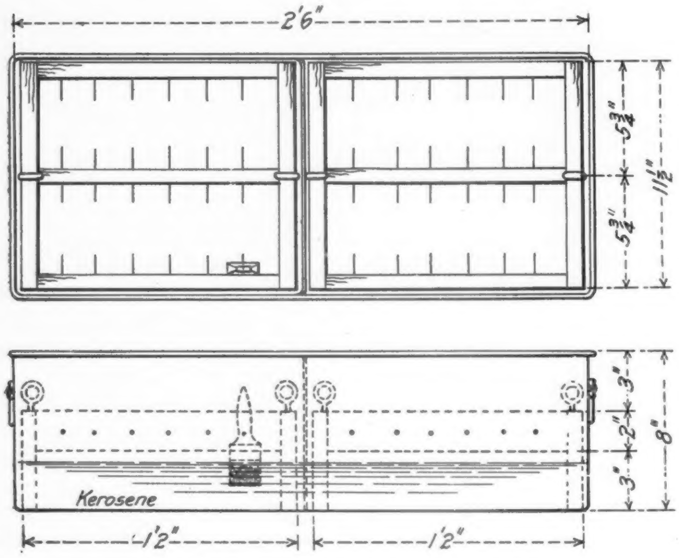


Fig. 3—Kerosene Tank for Paint Brushes.

to clean the tank. The tank is filled with about 3 in. of kerosene oil, and the brushes are hung on brads arranged around the wooden frame, holes being punched through the brush handles, so that the hair will be fully immersed in the liquid. If the brads are long enough three or small brushes may be hung on each one. The kerosene should be washed out of the brushes before they are used again.

GLASS CUTTING BOARD.

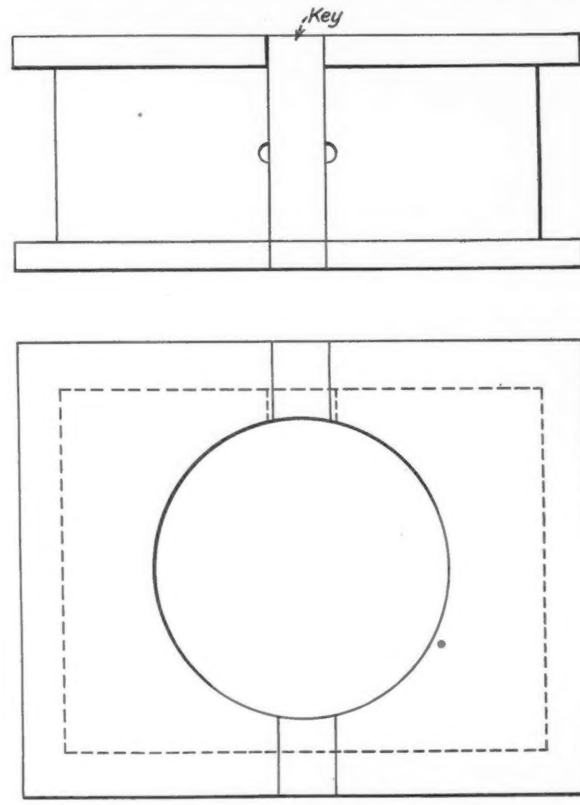
A glass cutting board with an adjustable stand is shown in Fig. 4. It should be made of hard wood, maple being the best. The left hand and lower edge should be marked and graduated in feet, inches and eighths of inches. The table will be found very useful in the paint shop, not only for cutting glass but as a drafting table.

LOCOMOTIVE ROD BRASS

BY J. E. OSMER

Master Mechanic, Chicago & North-Western, Boone, Iowa

On large modern power the cost of removing the rod brasses is quite a feature from a time and labor standpoint. The accompanying illustration shows a new type of brass which has been used with very good results. It is similar to the ordinary brass, except that it is provided with a brass key in the top and bottom, as shown in the drawing. This key has a flange on the outside only, so that when the collar and nuts, and the return



New Type of Rod Brass.

crank, if the Walschaert valve gear is used, are removed from the crank pin, it may easily be slipped out. The sides of the key are then planed and reinserted, which compensates for the wear on the brasses. The brass is then keyed up, the washer and nuts applied, and the job finished in a very short time.

Iron instead of steel for underframes has been specified in an order for 3,000 cars just placed by the Great Western Railroad, England. Iron is preferred as being less susceptible to corrosion.

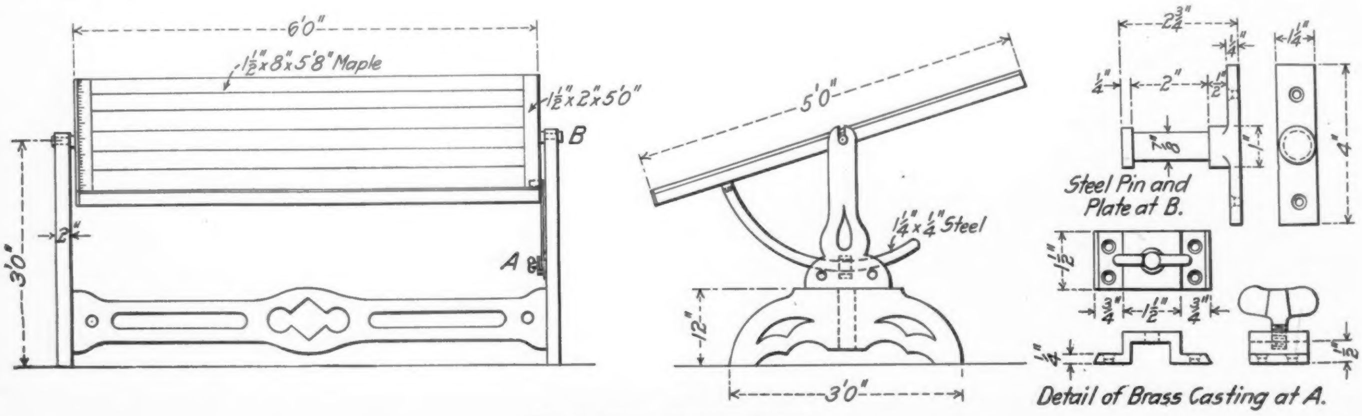


Fig 4—Glass Cutting Board.

Water Gas Replaces Oil For Furnaces

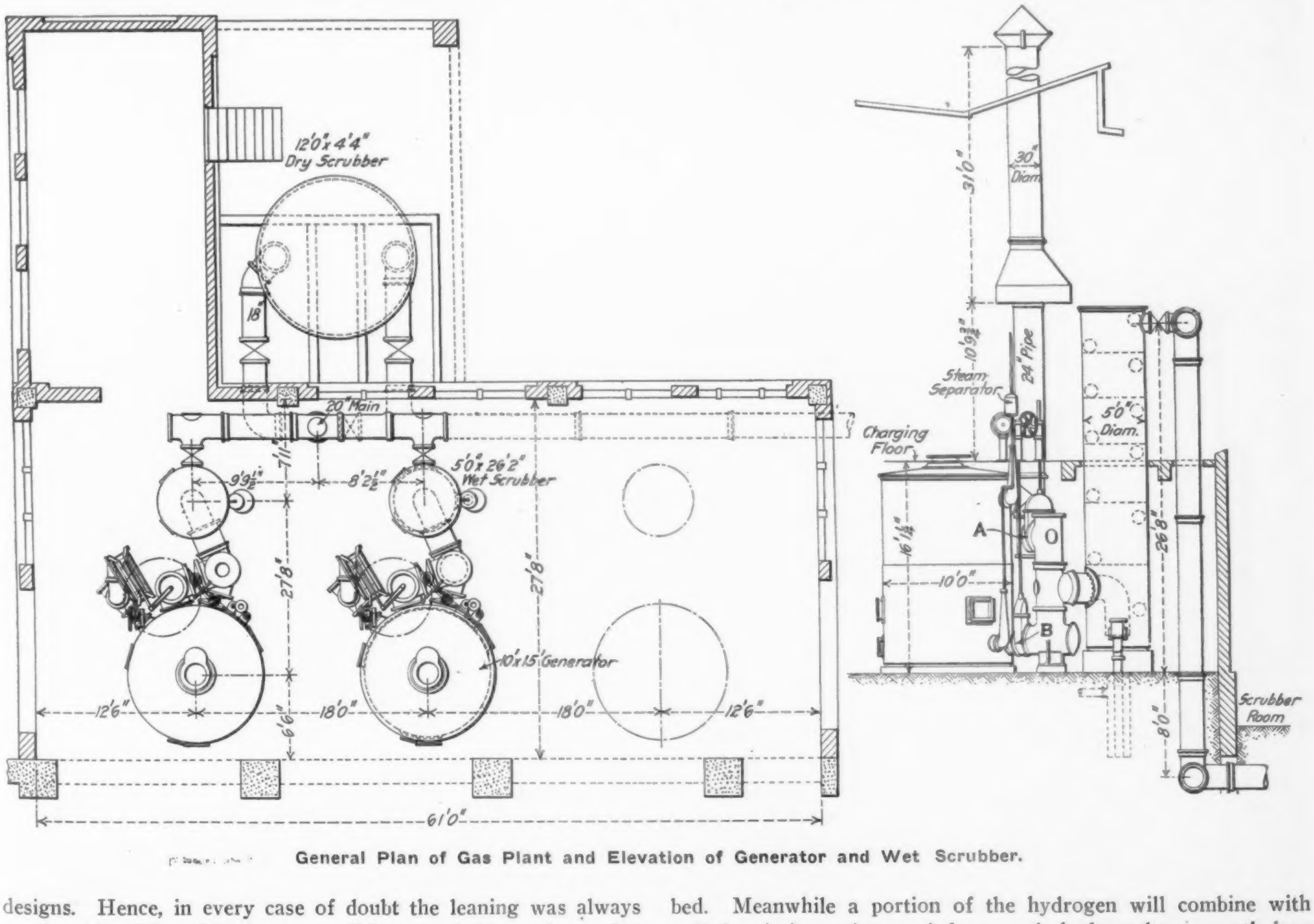
Furnaces at the Scranton Shops of the Lackawanna Have Been Operated with Water Gas for the Past Year with Marked Economy Compared with Other Fuels. Heats Work Rapidly, No Smoke, Easy to Regulate, No Ashes.

The installation of a gas plant and the use of gas furnaces in the Scranton, Pa., shops of the Delaware, Lackawanna & Western was such a radical departure from established practice that it attracted considerable comment at the time of its installation. This plant with its dependent furnaces have been in use for about a year, and have established themselves so thoroughly and satisfactorily as to warrant a detailed review of their operation and results. The project was a bold one. It involved not only a large initial investment, but the making of the major portion of the work of the blacksmith department dependent upon the gas plant. T. S. Lloyd, who was superintendent of motive power at the time, became convinced that the principle was economically possible, and that, this being the case, the details could be worked out in a way to make for the economic and operative success of the whole.

It is needless to tell any engineer that modifications have been made in the first designs of the furnaces installed. Neither the makers nor the users had had sufficient experience with this class of work and furnace to work with an absolute certainty on the designs. Hence, in every case of doubt the leaning was always on the side of insuring the accomplishment of the work, so that there has never been any delay due to a shut-down or furnace failures. Estimates were made and burners were provided that would be certain to do the work demanded, and these estimates and provisions were so liberal that in the modifications that have been made everything has tended towards a reduction instead of an increase of gas consumption. For example, in remodeling a number of the furnaces the number of burners has been reduced from 4 to 2, and these 2 have been made sufficient by lowering the roof of the furnace. Whatever change has been made it has been in detail and never in principle.

THE PLANT AND ITS OPERATION.

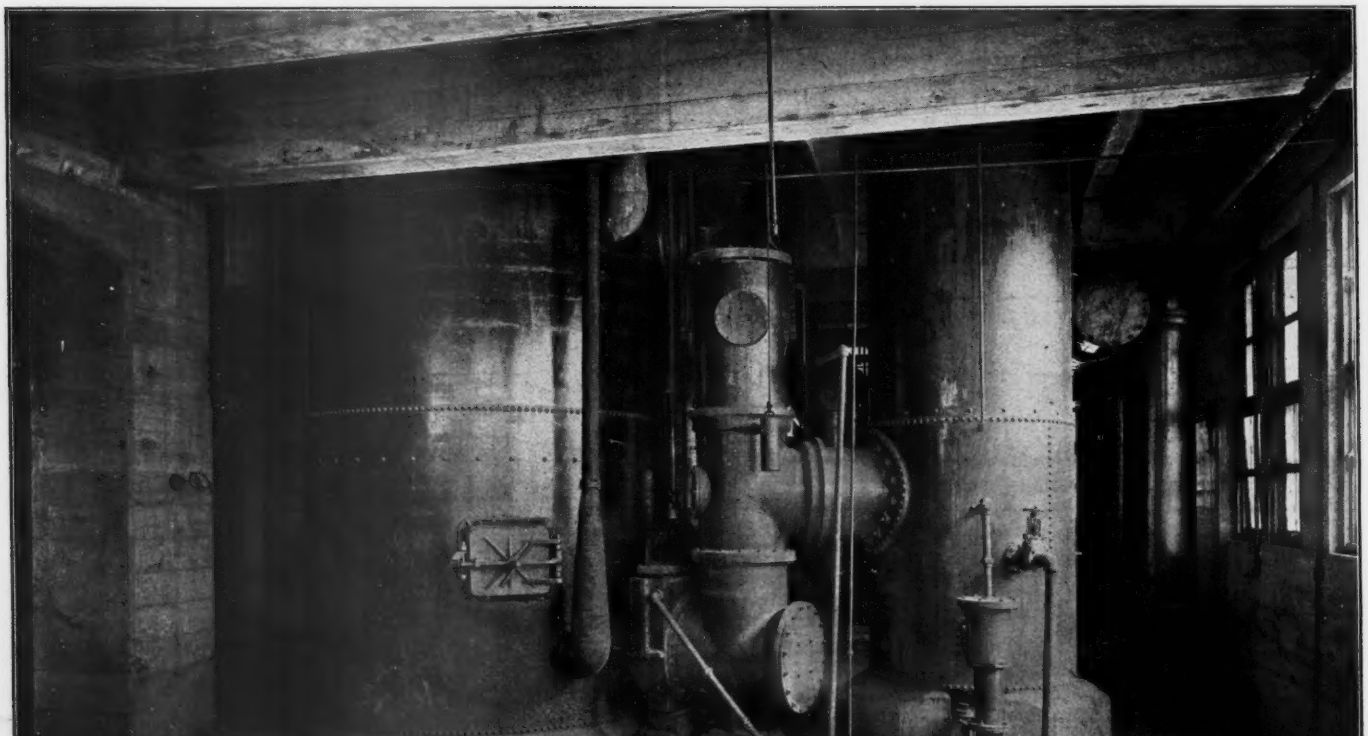
The gas used is that ordinarily known as water gas, and is a mixture of about equal parts of carbonic oxide or carbon monoxide and hydrogen. The formation of the gas is accomplished by passing a current of steam through a bed of incandescent coal. The chemical process is as follows: As the steam strikes the incandescent mass of coal it is heated to so high a temperature that it is dissociated and decomposed into its component elements, oxygen and hydrogen. The oxygen thus freed at once forms a new combination with the carbon of the coal and burns into carbonic acid gas, or carbon dioxide (CO_2), but in passing through the mass of hot coals this carbon dioxide is robbed of one of its atoms of oxygen and becomes carbon monoxide (CO) in which form it issues from the other side of the bed. Meanwhile a portion of the hydrogen will combine with a little of the carbon and from such hydrocarbons as ethylene (C_2H_2) and marsh gas (CH_4).



General Plan of Gas Plant and Elevation of Generator and Wet Scrubber.

It must be evident that the passage of steam through the incandescent mass of coals will have a cooling effect on it and that, if continued for a sufficient length of time, it would extinguish the fire. Hence the action of the generator must be intermittent, alternating between a rapid production of gas when the

Second Floor of Gas House Showing Top of Wet Scrubber.



Ground Floor of Gas House Showing Generator and Wet Scrubber.

steam is first admitted, and a production that falls away and would stop entirely if the steam were not shut off. This is followed by a blowing up of the fire followed by another run.

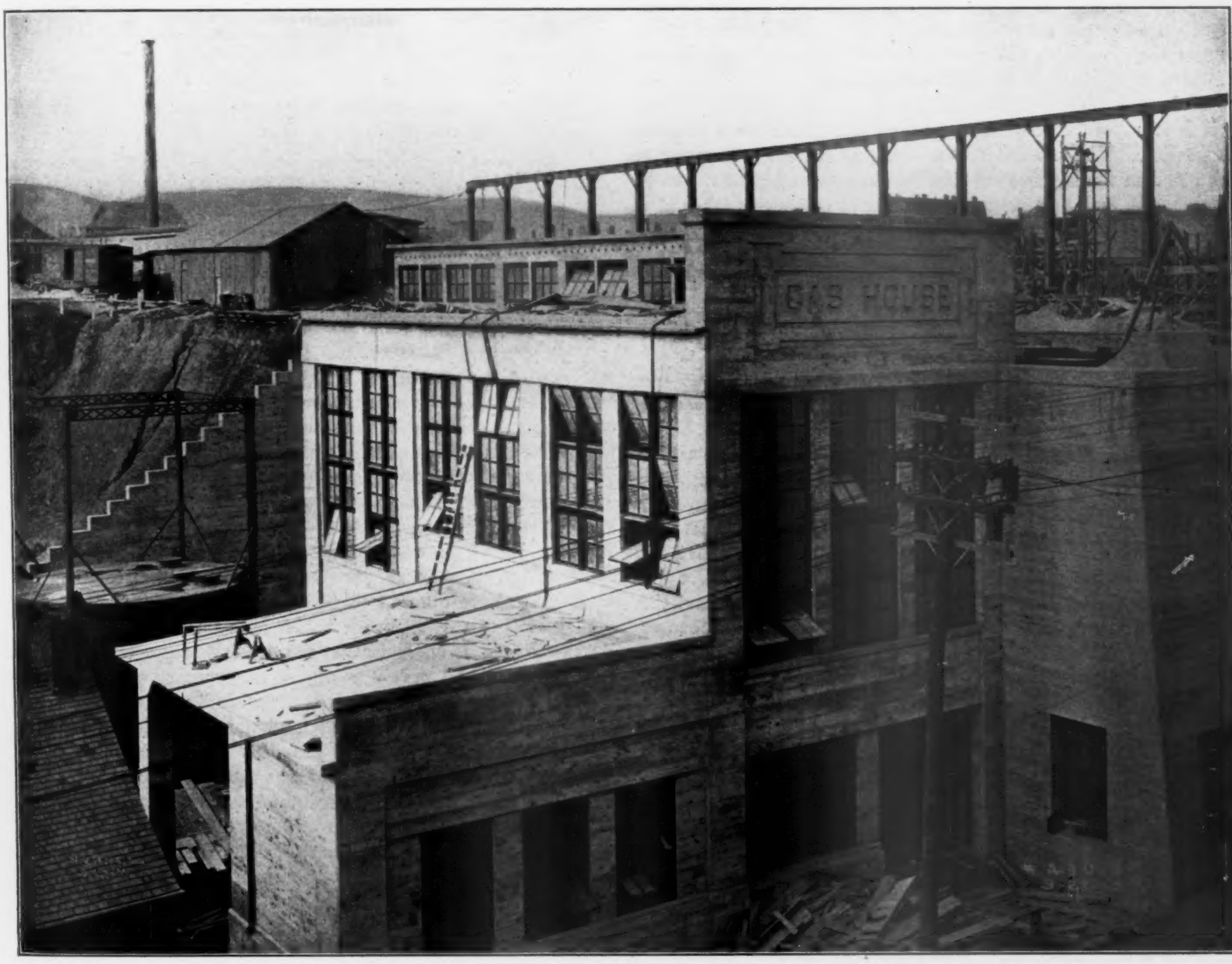
The gas plant was built by the Power & Machinery Company of Cudahy, Wis. It is located in a building of its own situated on the ground south of the tracks leading to the shops. It consists of two generators, a wet scrubber for each, a dry scrubber, a gas holder of 10,000 cu. ft. capacity, and a motor-driven blower for each producer, having a capacity of 7,500 cu. ft. of air per minute. The air is delivered to the ash pit at a pressure of 1 lb. per square inch, and the motors used for driving the fans are of 75 h. p. each.

The generator consists of a steel shell 10 ft. in diameter lined with 13½ in. of fire brick. The height is about 15 ft. At the top is a circular opening, flush with the second or operating floor of the building. The opening may be sealed air tight, and it is through it that the coal is charged to the generator. A flue also leads off from the upper portion, as shown, for carrying off the gas as well as the products of combustion when the fire is being blown.

At the bottom is a closed ashpit that is hermetically sealed, above which are arched grates set rigidly in place. Around the grates are three so-called fire-doors, also closing hermetically, which are used for cleaning out the ashes at the end of a day's run. Leading off from the ashpit is also another flue, which, connecting with the one from the top, leads to the bottom of the wet scrubber. The flues are shown at A and B in the drawings, and each is fitted with a large gate valve operated from the second floor. These gate valves are so connected to the operating wheel that one is opened as the other is closed. The stack for the discharge of the products of combustion during the blow-up process is closed by a tight damper setting down over the top.

The wet scrubber is formed of a cylinder about 5 ft. in diameter and 26 ft. high, in which are a number of perforated partitions each carrying a layer of cobble stones, over which water is sprayed. There is one of these scrubbers for each generator, the gas being admitted at the bottom and drawn off at the top. On admission its temperature, coming as it does direct from the producer, is about 2,300 deg. F. As it rises through the stream of water and the plates it is washed free of all solid matter that may have been entrained; the steam that may have escaped decomposition is condensed and the gas itself is cooled from 65 to 75 deg. F. It then passes to the main common to the two generators which are used and to a dry scrubber placed outside the building, the pressure being equal to about 10 in. of water. This scrubber is merely a box about 12 ft. in diameter and 4 ft. 6 in. high filled with coke, which takes up any moisture and solid matter that may have escaped the wet scrubber. From here the gas flows to an ordinary gas holder of 10,000 cu. ft. capacity.

The operation of the plant is exceedingly simple, but requires constant attention and care. The generators are banked for the night and, with the ashpit closed so that only a very small amount of air is admitted, the fire dies down. The ashpit door is closed upon a nail which holds it open about ⅛ in. The first thing in the morning, before six o'clock, the fans are started and



Gas Plant at the Scranton Shops; Delaware, Lackawanna & Western.

the fire is blown up by admitting the air to the ashpits; in about twenty minutes the generators are ready to make gas. The air is then shut off and the dampers are closed. Shortly after six the furnace fires in the blacksmith shop are lighted in order to have the furnaces hot for the commencement of the day's work. As soon as the indicator shows that the gas holder is dropping, the producer is started by admitting steam of 120 lbs. pressure to the ashpit. It rises through the bed of hot coals and passes out at the top as water gas. It takes about ten minutes to so cool the fire that no more gas is produced. The flow of gas to the scrubber is then shut off, the stack damper is opened and the air blast is turned into the ashpit. It takes about five minutes to blow the fire into a state of incandescence suitable for the making of gas. This done, the air is shut off, the stock damper is closed, and with the valve from the top of the generator to the scrubber closed and the one at the bottom opened, steam is admitted above the bed, forced down through it and out at the bottom to the scrubber. The object of the reversal of the flow of steam is to hold the fire at the bottom of the bed of coals.

It is essential that dry steam be used and at as high a pressure as possible. The evident reason for this is that any moisture contained in the steam must first be evaporated before it can be decomposed, and this evaporation requires so much heat that it has a strong cooling effect on the fire, and thus materially detracts from the gas-making possibilities. Hence a separator is placed in the steam pipe just above the valves controlling the flow.

At the end of the day's run the making of gas is stopped by simply shutting off the flow of steam after the gas holder has been filled. Then the fires are cleaned and banked. To do this the valves leading to the scrubber are closed and the stack damper is opened. Steam is then admitted to the ashpit and blown up through to the stack, and steam is admitted at the top and likewise blown out. The ashpit and door are then opened, and this must always precede the opening of the fire door above the grates lest an explosion occur because of the gas that has formed. The fire doors that are located immediately above the grates are then opened and the ashes are pulled out; there are usually from 800 to 1,000 lbs. With the ashpit cleared and the fire poked down from the top it is allowed to lie for an hour or so, when the generator chamber is filled with coal to within about 4 ft. of the top. It is then ready for the night.

The coal flows from the cars to the hoppers by gravity, and from them through the spouts shown in one of the photographs to the charging hole in the floor. On the lower floor the ashes are wheeled to a pit, whence they are elevated by a chain and bucket conveyor to the track and discharged into a waiting car.

The coal used is grate size of anthracite, which comes in lumps about the size of a man's fist. An average analysis of this coal may be taken as

Moisture, from	.98 per cent. to	1.16 per cent.
Volatile matter, from	5.14 per cent. to	5.88 per cent.
Ash, from	10.40 per cent. to	7.43 per cent.
Free carbon, from	83.48 per cent. to	85.53 per cent.
Total	100.00 per cent. to	100.00 per cent.
Sulphur, from	0.772 per cent. to	1.06 per cent.
B. t. u., from	13,495	14,156

An average analysis of the gas produced would run:

Carbon dioxide (CO_2)	3.60 per cent.
Oxygen (O)	.00 per cent.
Ethylene (C_2H_2)	.00 per cent.
Carbon monoxide (CO)	41.20 per cent.
Hydrogen (H)	51.50 per cent.
Marsh gas (CH_4)	.00 per cent.
Nitrogen	3.70 per cent.
Total	100 per cent.

The calorific value of such gas is about 312 B. t. u. per cu. ft. It will be seen that the combustible portions of the gas consist of a mixture of carbon monoxide and hydrogen, to which is added another portion of the inert gases, carbon dioxide and nitrogen, in nearly equal proportions and forming 7.3 per cent. of the whole. The gas is, therefore, practically pure and can almost be expressed by the formula CO + H.

COST OF GAS.

The amount of gas produced varies with the demand and runs from a little more than 300,000 cu. ft. per day to nearly 1,200,000 cu. ft., with an average of about 950,000 cu. ft. An analysis of one such average day's work is as follows, it being understood that a run is the gas produced by the application of the steam between two periods of blowing up the fire.

No. of runs, generator No. 1	24
No. of runs, generator No. 2	22
Cu. ft. of gas made in generator No. 1	483,400
Cu. ft. of gas made in generator No. 2	466,800
Total	950,200
Coal used	28,000 lbs.
Water used	205,875 gals.
Cost of coal	$30.80
Cost of water	14.41
Cost of labor	7.28
Total cost	$52.49

There are three attendants in the gas house and two laborers for half a day for cleaning the fires.

Coal per 1,000 cu. ft. of gas	29.46 lbs.
Water per 1,000 cu. ft. of gas	216.6 gals.
Gas per ton of coal	66,443 cu. ft.
Cost per 1,000 cu. ft. for coal	3.24 cents
Cost per 1,000 cu. ft. for water	1.52 cents
Cost per 1,000 cu. ft. for labor	.77 cents
Total cost per 1,000 cu. ft	5.53 cents

The guarantee of the manufacturers of the generator was for 64,000 cu. ft. per net ton of coal, and on the acceptance trial the production was 68,000 cu. ft. It is the opinion of the man in charge of the operation, as well as the officers of the mechanical department, that a production of 96,000 cu. ft. per ton of coal is easily possible if a gasholder were to be provided sufficient to make it possible to make all runs without shutting down. The present capacity of the gasholder is 10,000 cu. ft., and the rate of consumption is rarely less than 1,200 cu. ft. per minute, and often rises to 1,800 cu. ft. and more. With this small margin between supply and exhaustion to work upon the generators must be run so as to keep the holder nearly full at all times, so that it is rarely allowed to become less than half filled. If a generator is started when the holder is in this condition, the production of gas is so rapid that the demand is not only met, but the holder filled before the run is normally completed by the chilling of the fire. The result is the steam must be shut off and the generator allowed to stand until the holder is again partly emptied. Meanwhile the fire has been cooling and, when the steam is again turned on, the total gas production for the run is much less than it would have been had the run been a continuous one. To meet this difficulty it is the intention to install a new gas holder having a capacity of 50,000 cu. ft.

It will be noticed that the costs given for the gas include no overhead charges for interest, depreciation and repairs. Taking the interest and depreciation at 10 per cent. on the cost, they will be $4,000 per annum, or for 300 days, $13.33 per day. This, at the average rate of production given, will add about 1.4 cents per 1,000 cu. ft. of gas. To this must be added the cost of maintenance. The plant is too young for definite figures to be given for this item as yet, but it is estimated that it will amount to about 10 per cent. of the cost of production, and this will add .55 cents to the cost per 1,000 cu. ft. of gas. To this should be added the power required to drive the fans. The motors have a total capacity of 190 h. p., and with current at 1½ cents per kilowatt hour the daily cost (12 hours) will be $2.16, adding .23 cents more to the cost of gas per 1,000 cu. ft.

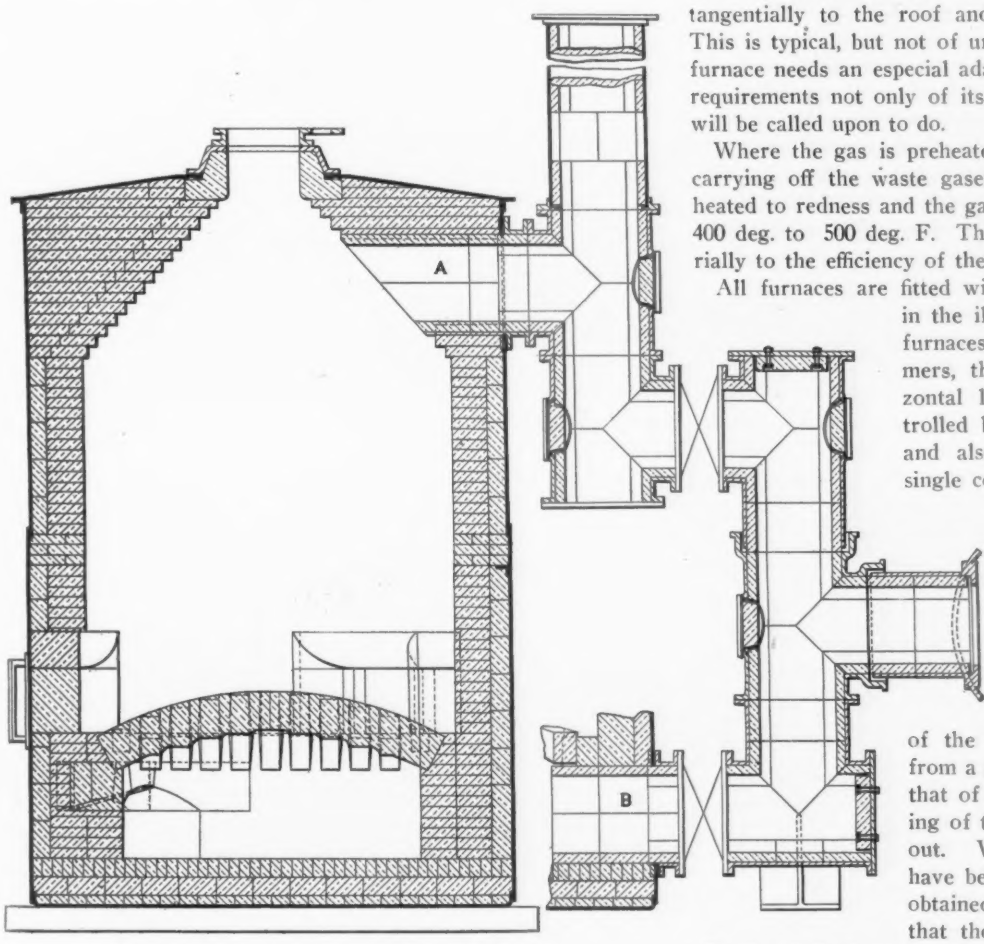
WHERE THE GAS IS USED.

Its principal consumption of the gas is in the furnaces of the blacksmith shop, where it is used for case hardening, tool dressing, and heating. There are a number of furnaces for serving heading machines, steam hammers, spring makers, drop hammers,

and for miscellaneous work. Then it is used for rivet heating throughout the boiler and machine shops, for tube welding and flanging. In the foundry it is used for the core ovens and brass furnaces; in the electrical department for melting babbitt and heating soldering irons; in the pipe department for pipe bending; in the laboratory for all heating work and in the machine shop for setting and removing tires. A list of the gas applications is as follows:

Blacksmith Shop.

1 Case hardening furnace	2 burners
1 Barium chloride furnace	2 burners
3 Tool dressing furnaces	2 burners each
5 4 ft. 6 in. heating furnaces	2 burners each
1 Heating furnace	1 burner
1 Spring banding furnace	2 burners
1 Spring fitters' furnace	2 burners
1 Spring heating furnace	2 burners
2 Heating furnaces	6 burners each
1 Miscellaneous furnace	2 burners
1 Drop hammer furnace	2 burners



General Arrangement of the Gas Generator.

Foundry.

5 Core ovens	1 burner each
3 Pit brass furnaces	2 burners each
1 Tilting brass furnace	1 burner
2 Core ovens	2 burners each
1 Pipe oven	1 burner

Electrical Shop.

1 Babbitt melting furnace	1 burner
2 Soldering irons.	
Hand torches.	

Mining Department.

1 Babbitt melting furnace	1 burner

Boiler Shop.

1 Annealing furnace	6 burners
3 Flue welding furnaces	2 burners each
Rivet furnace.	

Machine Shop.

Rivet furnaces.	
3 Babbitt melting furnaces	2 burners
Tire remover.	
2 Pipe bending heaters.	

In the machine shop connections are located at every third or fourth column throughout its length where a hose can be coupled and a rivet furnace set up. The extent to which the gas is applied can thus be appreciated.

The furnaces in the blacksmith shop and nearly all of the others were supplied by the Rockwell Furnace Company; some of the smaller ones were furnished by the American Gas Machine Company. Many have been slightly modified since they were installed by lessening the number of burners and lowering the roof. In construction the furnaces are very simple, but the adjustments of the burner location and roof heights must be carefully made in order to obtain the best results, and these rise to the highest point, both in temperature of fire and economical use of fuel, if the gas is preheated before recharging the burner.

A form of ordinary bolt heating furnace is shown in order to give an idea of the fundamental features of construction. It will be seen that the center lines of the burners are directed tangentially to the roof and floor of the furnace respectively. This is typical, but not of universal application, for each size of furnace needs an especial adaptation and adjustment to meet the requirements not only of its dimensions, but the work which it will be called upon to do.

Where the gas is preheated the pipes are run through a flue carrying off the waste gases. Here the gas pipe is frequently heated to redness and the gas is raised to a temperature of from 400 deg. to 500 deg. F. This has been found to add very materially to the efficiency of the furnace.

All furnaces are fitted with water shields in front as shown in the illustrations. In the large six-burner furnaces that serve the heavy steam hammers, the burners are arranged in a horizontal line across each end, and are controlled by valves for individual adjustment, and also by a master valve by which a single control of all the burners is obtained.

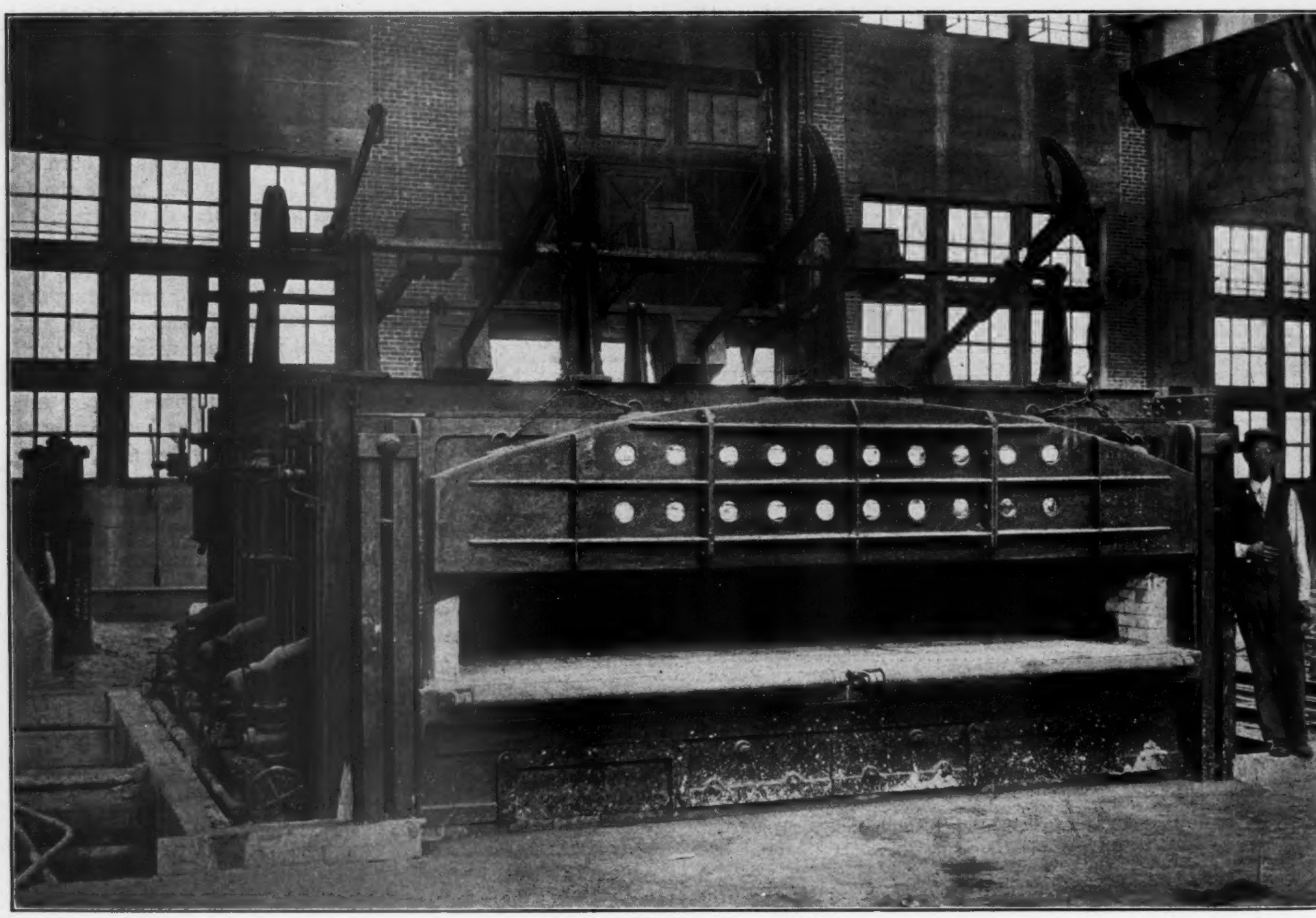
RATE OF HEATING.

As for the rate of heating it has been found to be a little more rapid than with oil, and yet not so fast as to burn the outside of a bar before the interior is heated. In fact, the opinion was expressed by one of the workmen that he thought the heat from a gas burner was more penetrating than that of either coal or oil, and that the heating of the metal was more uniform throughout. While no pyrometric measurements have been made of the furnace temperatures obtained at Scranton, it has been estimated that they run from 2,750 deg to 2,800 deg. F. In a bolt furnace a 1½-in. round bar can be heated ready for heading in a machine in about 2 minutes without burning; a 250-lb. pile of metal can be raised to a welding heat ready for the hammer in from 40 to 50 minutes, the record for the furnace being nine heats of nine piles each in a day of ten hours.

The flue furnaces are fitted with a water back against which the tube is placed so that the scarf is protected from burning. The capacity of one of these furnaces is at the rate of one tube in about 40 seconds, though they cannot be handled at this rate. The average output of a furnace capable of holding 3 tubes is about 550 tubes a day, which is about the same as with coke and 50 per cent. more than the same men say they could do with oil. The effect of the gas on the tube seems to be about the same as that of coke, in that it forms less scale and the metal is eaten away much less rapidly than with oil.

In removing and setting tires, the speed with gas is claimed to be higher than with gasolene. Before the gas was available 45 minutes was the average time required for the heating of

Gas Furnace for Steam Hammer Work.



Six-Burner Gas Heating Furnace.

a tire, while with the gas this has been reduced to 30 minutes. In this it is, of course, understood that there are many variations from these figures. This gives a general idea as to the speed of heating that may be obtained.

OTHER ADVANTAGES.

One crucial test as to the satisfactory operation of a device of this kind is the attitude assumed toward it by the men. In this respect there is a unanimity of agreement. In every case where an operator was interviewed he was not merely satisfied but enthusiastic in the results he was obtaining. The tire heaters, flue welders, bolt heaters and spring makers were a unit in considering it the best fuel they had ever used. In the case of the large furnaces the freedom from smoke, the ease of regulation, the absence of ashes and the rapid rate of heating had made a reduction in piecework prices possible. The heater called attention to the ease with which any desired regulation could be obtained. It is well known that under ordinary working conditions the back of the furnace is much hotter than the front. This necessitates great care in the heating of large objects that extend all the way across the furnace, lest the part next the back wall be burned. With the gas furnace this danger is easily obviated by merely turning off a part of the gas from the back burner. In like manner any desired degree of regulation can be obtained at the center and front, so that no matter what the size or shape of the piece it can be evenly and uniformly heated throughout and be in an ideal condition for the hammer when it is taken out.

This evenness of heating is very desirable in the tool furnaces. It is the intention, however, to remove the tool furnaces from the realm of guesswork as to temperatures and equip the one that will be used for the major portion of the work with a

Blowers in Gas House.

pyrometer. This step is in accordance with the suggestions made at the New York Railroad Club at the November meeting, though the action was taken before the suggestions were made. It is expected that the heating and cooling of the tool steel in accordance with pyrometric indications will make it possible to entirely avoid all cracks in tools because of faulty hardening and tempering.

The use of gas in the foundry core ovens is also satisfactory and results in somewhat more rapid drying than where coal was used. For example the time required to dry a cylinder core with coal was usually about 14 hours. With gas the work is always done in 12 hours and has been done in 6 hours. The average time required for the general run of cores was 6 hours for coal, while it is about 4½ hours with gas, and that too without parching or drying so hastily as to cause the cores to crumble.

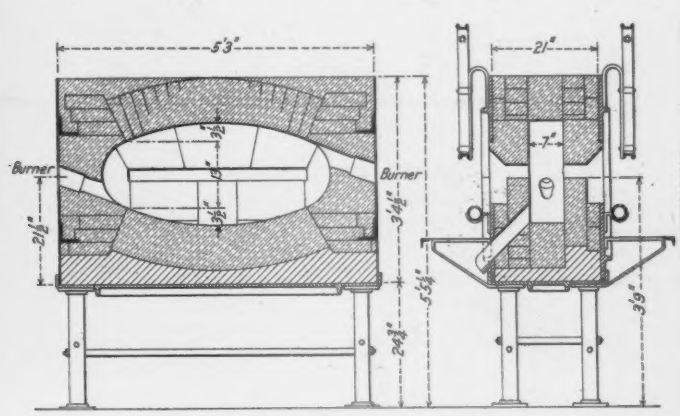
Dry Scrubber.

In the melting of brass there is but little difference between the use of coal and gas with the present arrangements.

Tests have been made to determine the gas consumption of the several furnaces when working to full capacity, and this is about as follows:

Brass tilting furnace with 2 burners....	1,980 cu. ft. per hour
Brass pit furnace with 2 burners.......	2,040 cu. ft. per hour
Core oven with drawers (1 burner)....	3,960 cu. ft. per hour
Large core ovens (1 burner)...........	3,300 cu. ft. per hour
Large 6-burner heating furnaces........	15,000 cu. ft. per hour
Heating furnaces with 2 burners.......	2,400 cu. ft. per hour
Miscellaneous furnaces with 2 burners..	4,020 cu. ft. per hour
Case hardening furnace with 2 burners.	3,600 cu. ft. per hour

From the evidence at hand it appears then that the use of gas on this extensive scale in the blacksmith shop and for miscel-

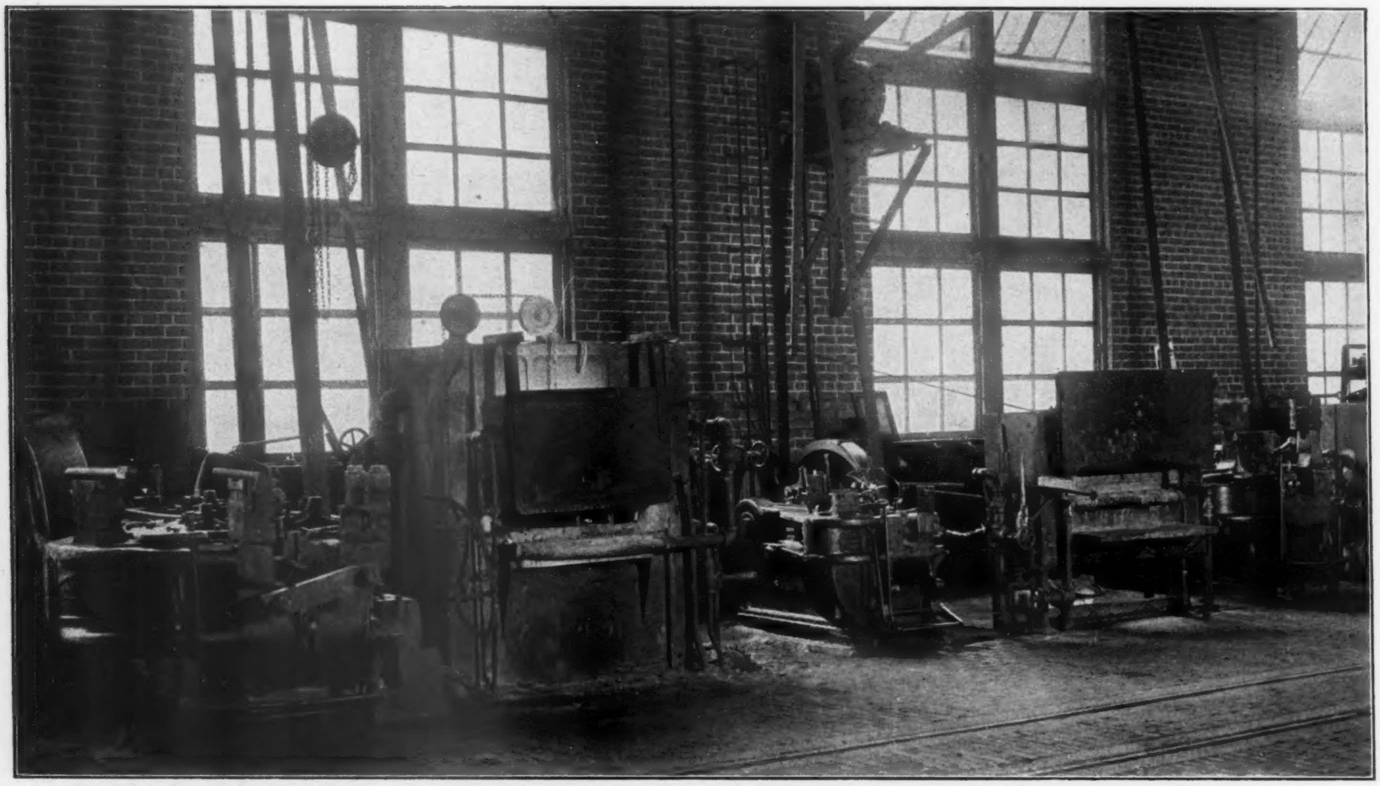


Bolt Heating Furnace.

laneous uses throughout the plant is a success as far as mere heating qualities and general convenience is concerned. It remains to consider it from an economical standpoint.

ECONOMY OF GAS FURNACES.

When the matter was under consideration before the shops were built it was regarded mainly in the light of the heat units that would be available and their cost. From analysis of the oil in use it was known that it had a calorific value of 133,000



Gas Furnaces for the Forging Machines.

Gas Furnace in the Spring Department.

B. t. u. per gallon, and that one pound of anthracite coal contained approximately 14,000 B. t. u., and that 62,000 cu. ft. of water gas, having an average calorific value of 300 B. t. u. per cubic foot, could be produced from a ton of coal, making a total heat production per ton of 18,600,000 B. t. u., which is equivalent to 140 gal. of oil, which at 3.35 cents per gal. would cost $4.90 as against $2.20 for coal, making a saving of 55.2 per cent. in favor of gas. The estimated cost of fuel and capital charges for an oil consumption of 3,000 gal. per day at 3.35 cents per gal. was $103.43, and for gas $76.21, making a net saving of $27.22, a saving that would be correspondingly increased by a rise in the price of oil.

As soon as the shops were ready for operation a three days' test was made, in which 1,483,905 cu. ft. of gas was made. The costs were

Coal, 57,640 lbs.	$63.20
Supplies	.30
Water, 208,980 gals	14.63
	$78.13
Labor	14.70
Total	$92.83
Average cost of gas per 1,000 cu. ft.	6.25 cents
Average cost per day to operate gas plant with one generator	$30.94
The cost of operating the blacksmith shop with gas for three days—	
845,774 cu. ft. of gas at 6.25 cents per 1,000 cu. ft.	$52.86
Average per day of	$17.62

Several estimates for the foundry core ovens place the cost at $11.52 per day, and $1.42 per day for the brass furnaces. On this basis the following comparative statements were made in connection with the costs of operating the old blacksmith shop and foundry.

Old Smith Shop. Fuel Oil.	*New Smith Shop.* Gas.	*New Smith Shop.* Fuel Oil.
$19.29	$17.62	$29.32
Core Ovens.		
Old Foundry. *Coal.*	*New Foundry.* Gas.	*New Foundry.* Fuel Oil.
$6.40	$11.52	$11.84
Brass Furnaces.		
Old Foundry. *Coal.*	*New Foundry.* Gas.	*New Foundry.* Fuel Oil.
$3.44	$1.42	$3.52

These figures do not include overhead charges and may be taken to represent the maximum costs for gas when the generators are not working to full capacity.

Taking these in connection with those given earlier where the rate of production is about 950,000 cu. ft. per day, it will be seen that they are much higher. If the demand is increased it seems possible that the bare cost of making gas may be reduced to 3 cents per 1,000 cu. ft. or less.

Of course this low cost is directly due to the low cost of anthracite coal at Scranton, but if the cost were to be taken as proportional to the price of coal, and basing an estimate on the production given in the test cited of about 494,635 cu. ft. per day, it would be possible to pay $3.65 per ton for coal and equal the cost with oil at 3.35 cents per gallon.

These figures will naturally need revision with the local conditions of the place to which they are to be applied, but as far as the Scranton plant is concerned, the officials consider it a practical and economic success, while the workmen look upon it as of value to themselves and more than satisfactory in its operation.

FUEL ECONOMY.—If 1 lb. of carbon is completely burned to CO_2, it will give out about 14,500 B. t. u., and if only partially burned to CO, it will give only 4,500 B. t. u., showing a loss of about 10,000 units. It is therefore obviously necessary, for the sake of economy, that the carbon should be thoroughly burned, which means that very little, if any, smoke should be produced.

INTERESTING DESIGNS FROM ABROAD

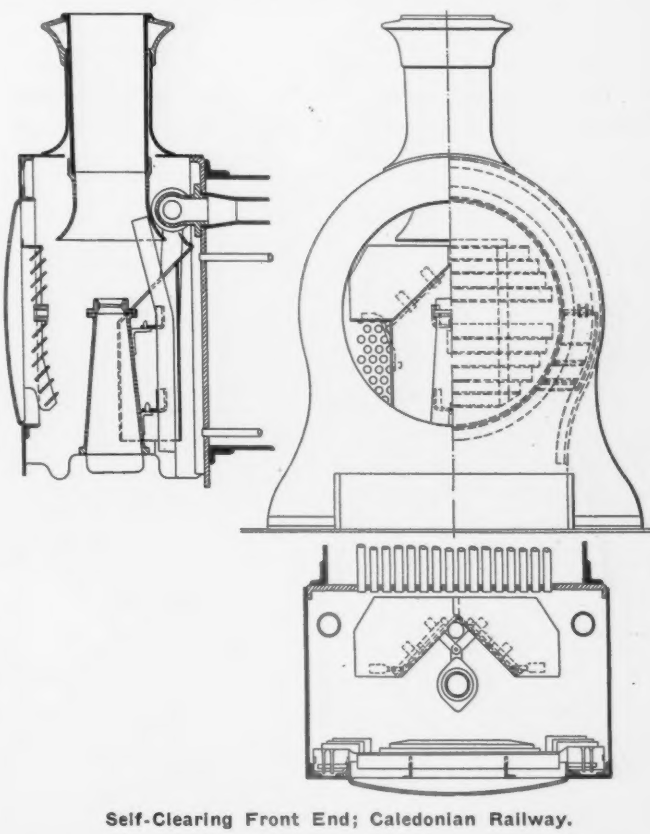
The Caledonian Railway of Scotland is Using Curved Tender Journals, Novel Spark Arrester and a Tire Fastening for Coach Wheels.

BY GEORGE SHERWOOD HODGINS.

During a recent trip to the British Isles the author was much interested in inspecting the present day practices and the motive power equipment on the various railways and found many arrangements and designs which were novel and apparently successful. These features were particularly noticed during a visit to the St. Rollox shops of the Caledonian Railway. Among the many things observed, the features of motive power and rolling stock equipment, illustrated and described herein, seemed to be of special interest to American railway men.

LOCOMOTIVE SPARK ARRESTER.

At first thought it would seem that in the moist climate of Great Britain the matter of spark prevention would be of considerable less importance than in this country. This, however, does not seem to be the case, and as careful attention is given to this feature on the Caledonian as on any American railway.

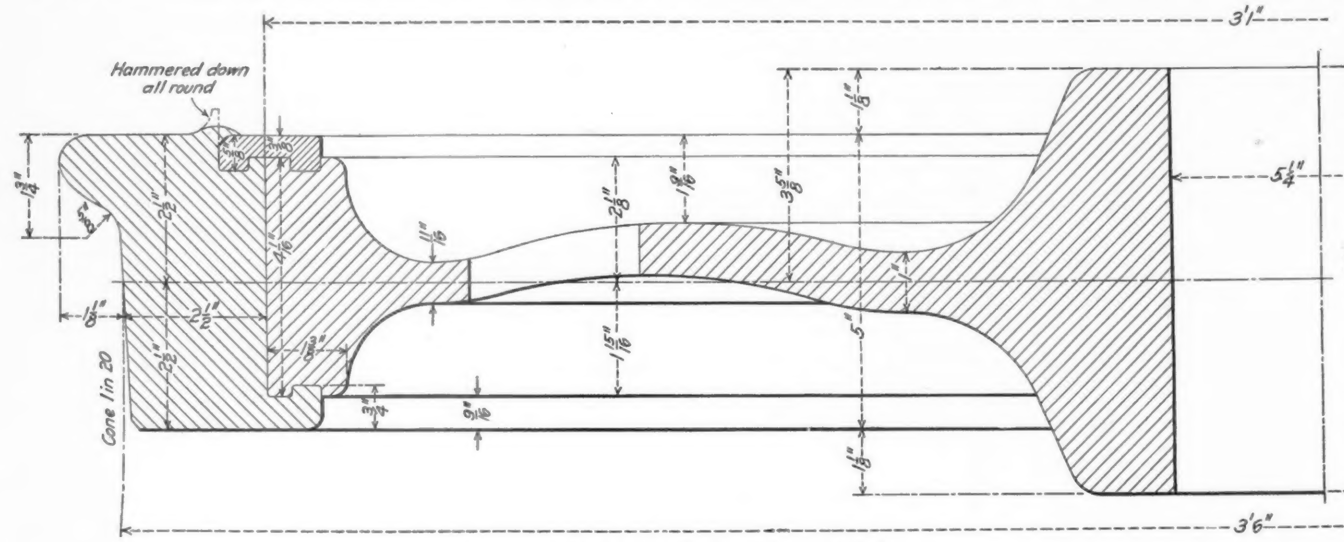


Self-Clearing Front End; Caledonian Railway.

A smoke box being applied by J. F. McIntosh, locomotive superintendent, to a large number of locomotives is shown in the accompanying illustration. It consists of a pair of plates secured at right angles to each other and placed vertically behind the exhaust pipe forming a wedge at this point. From a point above the top line of flues a deflector plate is carried down to the top of this wedge, thus compelling the cinders from all of the flues, except a few at each side below the center line, to strike the sides of the wedge. From here most of them continue to the front lower corners of the smoke box. On the inside of the door is a frame carrying a number of slats, their forward edges inclined downward, and a somewhat larger set of slats is placed in the lower front corners. The action of the exhaust blast carries the cinders up through the louvers or openings between the slats and out through the stack. This baffling of

the cinders against the plates and the slats causes them to become dead before being ejected.

In the lower back corners of the smoke box the draft has less effect and some cinders accumulate at these points. To obviate this, two pipes are arranged with their lower ends reaching into these corners; the upper ends enter the base of the stack extension. The suction through the pipes keeps the lower back corners clear. This arrangement of front end has proved successful and is being applied to all locomotives.

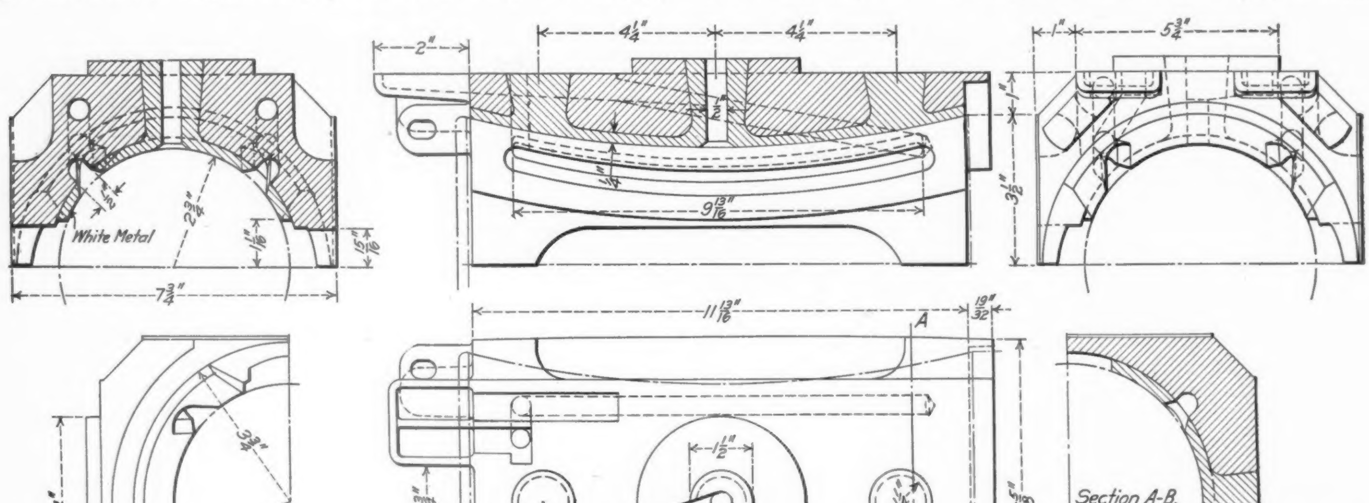


Sectional Tire Fastening for Coach Wheels.

TIRE FASTENING FOR COACH WHEELS.

The tire used under the latest passenger coaches differs in contour from that used in this country, and may be said to be peculiar to the Caledonian Railway. It is 5 in. x 2½ in. in section, and has a straight coning of 1 in 20. The wheel is made with a notch in the outer face of the rim, and into this notch fits a projection on the tire. When the tire is shrunk or pressed on the wheel center the tire and rim fit snugly together on the outside. At the back is a notch in both the tire and the rim, and into this a ring is fitted and a projecting edge or lip on the tire is hammered down on the rounded upper corner of the ring. The ring is not dependent on shrinkage for its holding power. It is therefore carefully fitted and the turned over edge of the tire prevents it from coming out. The ring is made in four segments, and at the junction of each segment is a key ¾ in. x 4 in. bedded into the ring and fitted tightly to cover the thin portion of the ring. The edges of the ring surrounding the key are hammered over and made secure.

In case the tire became loose and has to be taken off, or has reached its thickness limit, the keys are taken out and the ring removed in four pieces. When a new tire is applied, the four segments of the ring are used without alteration by employing a shorter key, if necessary. The wheels are made of steel, single plate curved or "dished" toward the axle by 7/16 in. The plate or web of the wheel is 1 in. thick near the hub and 11/16 in. thick where it joins the rim. The radius to which the plate is curved is 11 in., and the wheel seat on the axle is 7 in. x 5¼ in. The diameter of the wheel is 42 in. over the threads.



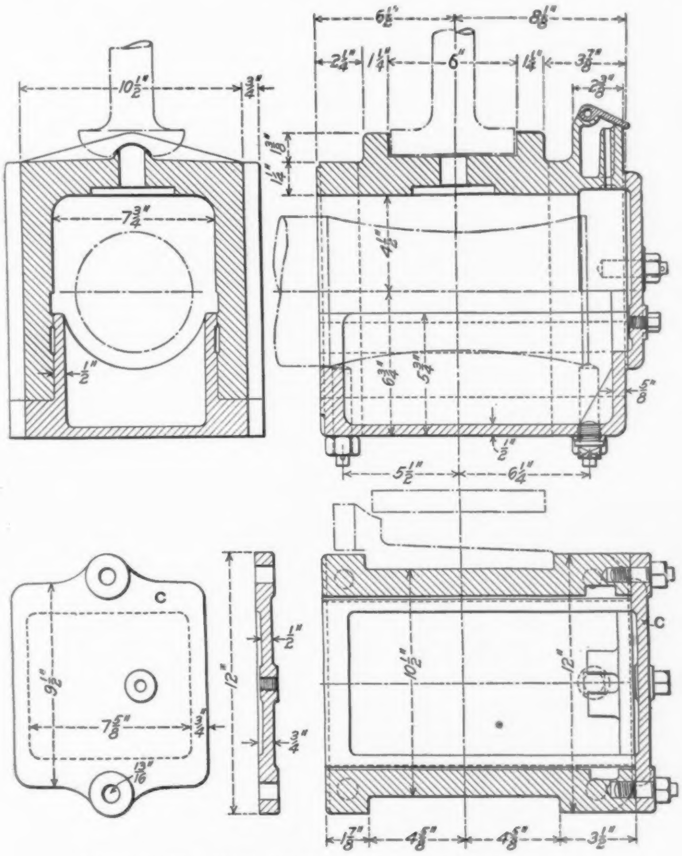
Brass for Curved Tender Journals.

CURVED TENDER JOURNALS.

A journal which has been in service for a long time generally shows wear by becoming hollow in the center, and on the Caledonian Railway a form of tender journal is used, which is made

hollow when new. On all the latest express tenders, which have a capacity for 5,000 gals. of water, these journals have given satisfaction and their use is to be extended.

As used on the tenders, the journals are 12 in. long by 7 in. in diameter at the ends and 5½ in. in diameter in the center, the radius of the curved surface being 2 ft. ¼ in. The journal box and brass are ingeniously designed to suit this condition. At the center of the top of the box a certain amount of free motion is allowed the equalizer bar, which is made with a foot to engage with a rounded rib on the top of the box. An oil cellar is bolted to the bottom and a cover is secured to the front by bolts. There is a plug for draining the oil out of the cellar and one in the cover for examining the journal. The brass has a lining of white metal, and is of course curved to suit the shape of the journal. There is one oil hole in the center and two



Journal Box Used With Curved Tender Journals.

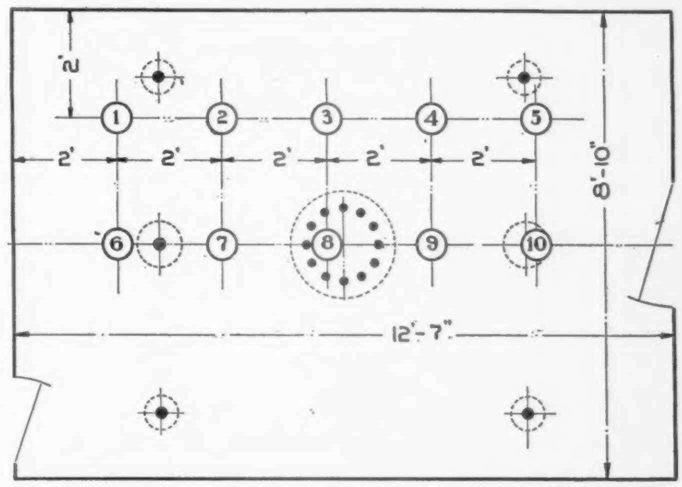
oil grooves along the sides of the brass, as shown in the illustration. On the front top corner of the box is a small oil chamber cast integral, in front of which there are four ⅜ in. holes leading to the interior of the box. This oil chamber is covered by a lid and the oil is fed through the holes by cotton wicks which drip into 4 different receptacles on the front end of the brass. From one of these there is a passage feeding oil to the center of the journal, from another the passage leads to the front end of one oil groove, and from the other two the passages lead to the back end of both oil grooves. The oil passes from these receptacles to the journal by gravity.

In this manner the center and front of the axle receive equal amounts of oil while the back receives as much as the other two together. The reason for this is that in actual service the front of the brass does not carry as much weight as the center, nor does it generate as much friction as the back. The center is where the direct weight is applied and the oil from the grooves will naturally feed to this point and the extra oil feed directly to the center is intended largely as an emergency. The back end of the brass receives the most oil, as experience has shown that this point becomes dry first.

INDIRECT LIGHTING FOR RAILWAY CARS

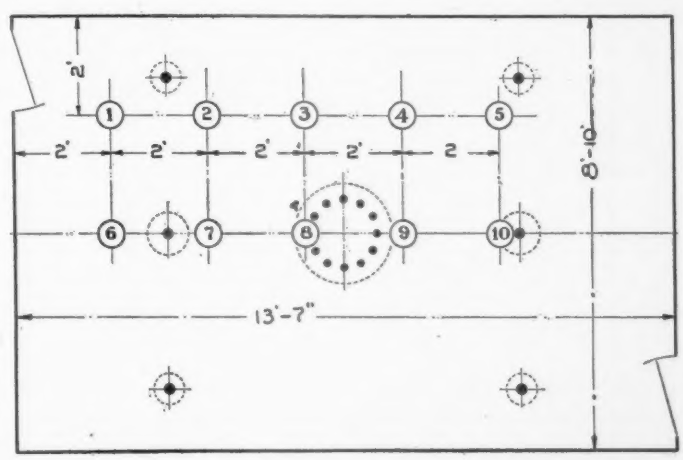
Indirect lighting has been used to a considerable extent in hotels where it is desired to secure an even light and soft tones. It is also used in the new Washington terminal of the Pennsylvania Railroad, but in that particular case it presents a peculiar effect due to the fact that the walls and equipment in the building are white, thus reflecting the light so that it casts no shadows, in some instances making it difficult to recognize persons with whom one may be well acquainted.

The possibility of using indirect lighting in railway cars was first considered in connection with the private car of B. F.



Plan of Observation Room Showing Where Illumination Readings Were Taken.

Yoakum, chairman of the board of directors of the Frisco Lines. The first cars to use the indirect lighting in actual service were the Santa Fe dining cars on the Train de Luxe, which were illustrated in the *Railway Age Gazette* of December 15, 1911, page 1207. Mr. Yoakum's car, which was built at the St. Charles shops of the American Car & Foundry Company, was slower in building than the Santa Fe diners, which preceded it in service by a few days. The indirect, or more correctly the semi-indirect,



Plan of Dining Room Showing Where Illumination Readings Were Taken.

method of lighting is used in the dining and observation rooms of Mr. Yoakum's car.

The lighting fixture in the dining room is placed in the center of the room and is supported by four cast bronze chains. The bronze or metal portion is finished in verde antique and the bowl is made of leaded glass, which is of sufficient density to give a soft color when lighted by the lamps inside of the bowl. No useful light for illuminating the room passes through the bowl. Underneath the twelve 25-watt tungsten lamps is placed a metal

reflector, which redirects the downward rays of light to the ceiling of the room, allowing just enough light to pass the reflector to light the colors in the glass bowl. The ceiling of the dining room is finished in a dull ivory white, while the side walls are finished in mahogany and the carpets are green.

Lighting Requirements in Foot Candles for Various Services as Compiled by Barrows.

Assembly rooms, corridors, public spaces	5	to	1.5
Auditoriums, theaters	1	to	3
General illumination of residences	1	to	2
Reading { Good clear print	1	to	1.5
Reading { Newspaper print	2	to	2.5
Reading { Postal service	2	to	4
Churches	2	to	4
Library { General illumination	1	to	2
Library { Reading tables	3	to	4
Ball rooms	2	to	3
Desk lighting	2	to	5
General illumination of stores	2	to	5
Bookkeeping and clerical work	3	to	5
Clothing stores	4	to	7
Display of dark goods	5	to	10
Drafting, engraving	5	to	10
Street lighting by gas	0.05	to	0.25
Street lighting by electricity	0.05	to	0.60
Light from full moon	0.025	to	0.03

The center lighting fixture in the observation room is similar under the lower deck in both the dining and observation rooms. Both the center fixtures are large compared with those usually found in cars. The effect when lighted and also in the daylight

Illumination in Dining Room, Using Twelve 15-Watt Tungsten Lamps.

Station.	Foot Candles.	Station.	Foot Candles.
1	1.60	6	1.82
2	2.02	7	2.50
3	2.20	8	2.20
4	2.20	9	2.50
5	1.68	10	2.55

Average, 2.06 foot candles.

Illumination in Dining Room, Using Twelve 25-Watt Tungsten Lamps.

Station.	Foot Candles.	Station.	Foot Candles.
1	1.81	6	2.10
2	2.30	7	2.95
3	2.68	8	3.00
4	2.70	9	3.40
5	1.88	10	3.00

Average, 2.48 foot candles.

Dining Room of Frisco Private Car Showing Fixture for Indirect Lighting.

to the one in the dining room, except that the glass bowl is leaded with a combination of frosted, white granite and amber glass; the latter is used sparingly—just a spot here and there for design and to relieve the monotony of the frosted and granite glass. The ceiling of the room is finished in a cream white and the side walls are of mahogany.

Two small electric lamps, of the direct lighting type, are located is pleasing; this is due to the severe interior treatment of the rooms. The mahogany finish is very plain, with simple molding and plain panels. The large lighting fixtures are, therefore, the only decorative spots in the rooms and lend themselves to the color schemes and finish.

That the illumination from these central fixtures is exceedingly good in both the rooms may be seen from a study of the readings

at various points, which were obtained with a Sharp Miller illuminometer. The readings were taken 3 ft. above the floor, and their value may be more readily understood by reference to the table showing the requirements in foot candles for various services, as compiled by Barrows. The location of the points at which the readings were made is shown on the accompanying

ILLUMINATION IN OBSERVATION ROOM, USING TWELVE 15-WATT TUNGSTEN LAMPS.

Station.	Foot Candles.	Station.	Foot Candles.
1	2.26	6	2.43
2	3.20	7	4.20
3	3.60	8	6.40
4	3.40	9	4.62
5	1.96	10	2.70

Average, 3.28 foot candles.

diagrams. The direct electric lights were not in use when these readings were taken.

Indirect lighting will undoubtedly be used extensively on private cars, dining cars, and possibly parlor cars. The effect of the light is most pleasing, but a considerably larger amount of power is required than for ordinary lighting. The fixtures in Mr. Yoakum's car were supplied by the Safety Car Heating & Lighting Company. Fintsch gas is used as an auxiliary.

CAR DEPARTMENT KINKS*

BY W. H. WOLFGANG,
Draftsman, Wheeling & Lake Erie, Toledo, O.

PLATFORM FOR CARRYING SCRAP MATERIAL.

The method of removing scrap material from large shops by means of a laborer with a wheelbarrow is an expensive

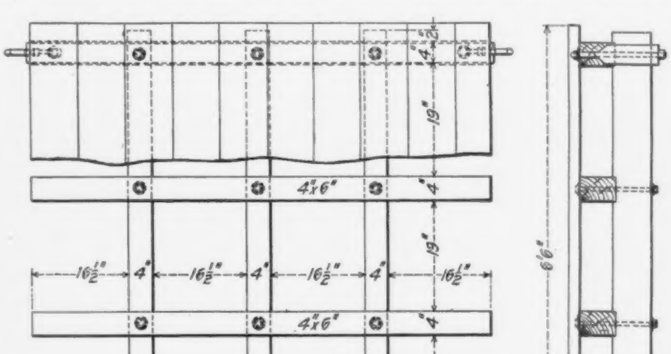


Fig. 1—Wooden Platform for Carrying Scrap.

proposition, as much time is spent in wheeling the small loads to the scrap pile. The wooden platform shown in Fig. 1 may be used for this purpose. It is 6½ ft. square, and is made of 4 in. x 6 in. timbers, which may be taken from old car sills. It is carried from place to place by means of cranes, four chains fixed in one ring being used to lift it. Each chain has a hook fastened at its other end which fits in the 2 in. eyes at the four corners of the platform. With these platforms located at various parts of the shop, scrap may be easily collected. When a platform is full the crane takes it to the end of the shop and dumps it in a scrap car, or on the scrap heap. When unloading, two chains are removed from one side, and when the other side is lifted, the scrap will roll off the platform. The floor of the platform should be of 1¼ in. oak firmly spiked to the timbers. The 1¼ in. x 3½ in. iron truss rods are made from old arch bars with a ring forged on each end for the hooks. If desired, side boards may be added to the platform so that it will hold more

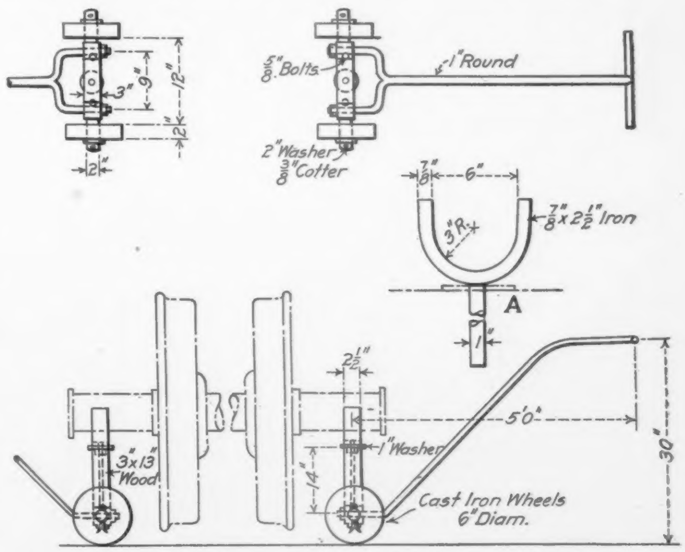


Fig. 2—Truck for Handling Mounted Car Wheels.

material. It can also be used to good advantage in transferring small material from place to place in the shop.

TRUCK FOR CONVEYING MOUNTED WHEELS.

The truck shown in Fig. 2 is used for transporting mounted car wheels, and may be made at a reasonable cost. Two 6 in. cast iron wheels are mounted on a 2 in. x 3 in. steel axle, which has a 3 in. x 13 in. oak block bolted to it. This block has a 1⅛ in. hole through the center for the yoke *A*, which is made of wrought iron or open hearth steel ⅞ in. thick by 2½ in. wide. The handle of the truck is made from open hearth steel and is bent to the shape shown. To use the truck it is tipped forward and the yoke is placed underneath the journal of the axle; by bearing down on the handle the wheel is lifted from the floor. This truck is quite similar to the one described in the *Railway Age Gazette* of December 1, page 1113.

PLATFORM FOR STEEL HOPPER CAR SIDES.

The platform shown in Fig. 3 is handy for riveting, cutting out rivets, or straightening the sides of steel hopper cars. It is

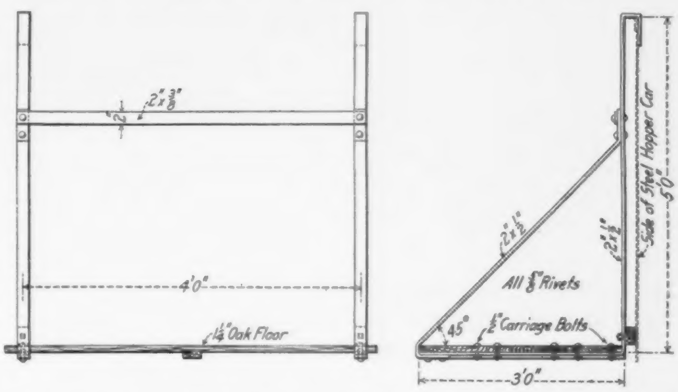


Fig. 3—Riveting Platform for Sides of Steel Hopper Cars.

made of two pieces of 1½ in. x 2 in. bar iron, which is bent at the top so as to easily slip over the top of the side of the car. A 1¼ in. oak floor is bolted to the horizontal portion of these bars. Iron braces help support the floor of the platform.

*Entered in the *Railway Age Gazette* Shop Kink Competition which closed September 15, 1911.

JOURNAL BOX COOLER.

A handy device to be carried in the emergency tool box of passenger equipment is shown in Fig. 4. It is a small tank of No. 24 galvanized iron of the general shape shown in the illustration, and is used for hot boxes. It may be readily hung underneath the cars by two chains fastened to the body side sills, and having hooks fitting in the rings *A* of the cooler. It has four legs

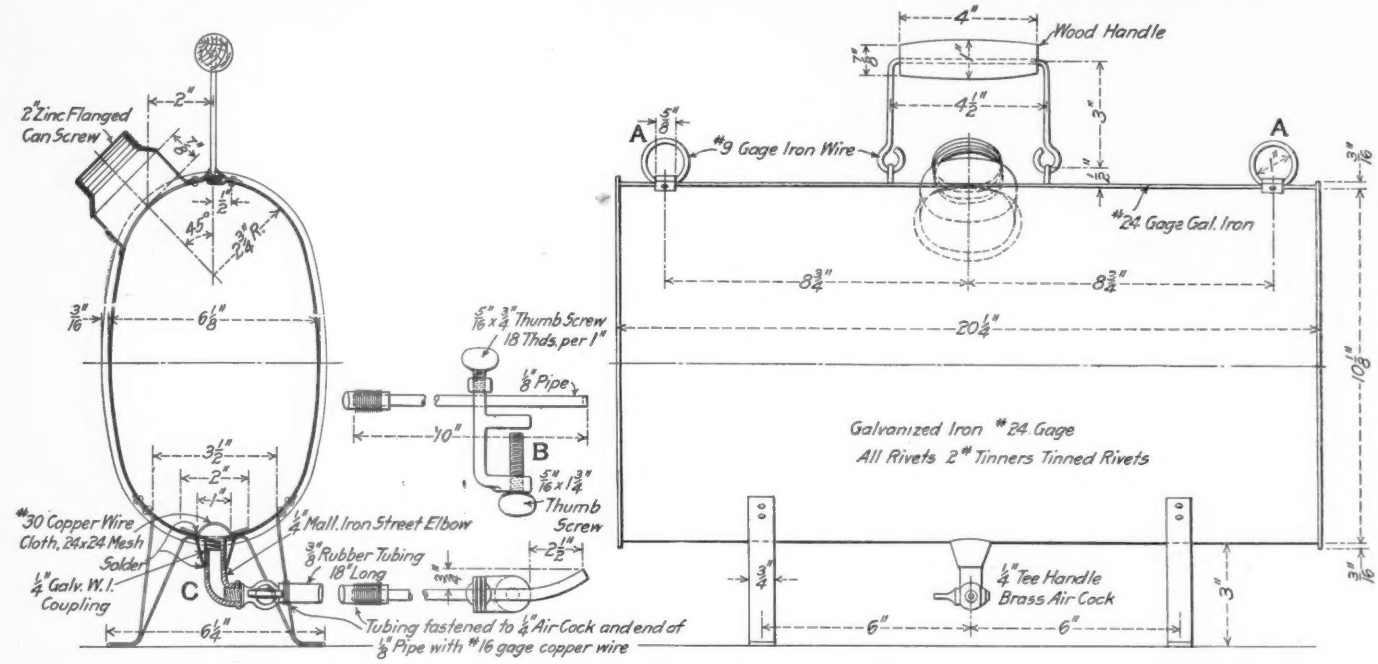


Fig. 4—Water Tank for Cooling Hot Journal Boxes.

of galvanized iron which may be set on the truck timbers, being held in place by light chains. The clamp *B* holds the rubber hose to the journal box, so that the water will keep running on the bearing. A copper wire cloth or screen is used to prevent any sediment or dirt running from the tank into the bearing; the flow of water is regulated by a cock at the end of the malleable iron Street elbow. With this device, after the journal box has once been filled, a constant stream can be played on the journal while the train is running between stations, the tank

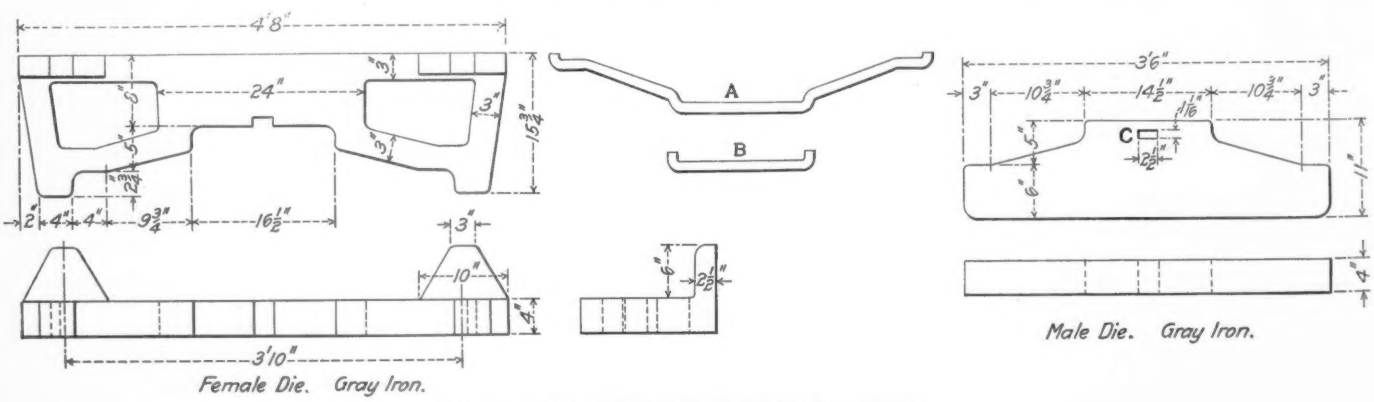


Fig. 5—Bulldozer Dies for Forming Carry Irons.

being refilled at each stop. A wooden handle is fastened at the top of the tank, so that it may be carried easily.

FORGING CARRY IRONS.

The dies shown in Fig. 5 are used for forming drawbar carry irons. The two pieces, *A* and *B*, are made with the same die. The female die is bolted to the bulldozer head and the male die to the face plate. There is a rectangular hole at *C* in the male die for the leg of a fork which holds the hot bar in place. A slot is also cut out of the female die to receive the other part of the fork.

CRANE FOR HANDLING TIMBER.

The traveling crane shown in Fig. 6 is used in the lumber yard for loading and unloading timbers under 12 ft. in length. A pneumatic hoist is used on a trolley which travels on the 12 in. I-beam, that is 50 ft. long. Two tracks are left open for cars; one is for the delivery of the lumber and the other is for a lorry truck which carries the timber in and about the shop. The crane legs are made of 2½ in. pipe, and are strengthened on each side with ½ in. truss rods. A brace at *A* is made of 2½ in. pipe and is bolted to the 12 in. I-beam, being screwed into a special fitting on the legs. The wheels on the trucks are made of cast iron, and are 8 in. in diameter, having flanges on each side to keep them from jumping the track. Old rails are used for the track and are spiked to 6 in. x 8 in. old car sills, which run the full length of the yard. The I-beam is bolted to the top of the legs. It is strengthened by two ½ in. truss rods. The bottoms of the legs are held in a wrought iron frame in which the wheels are mounted.

The cylinder of the hoist is made from a piece of 7 in. standard pipe with a closed head on one end and a head with a hole 1⅝ in. in diameter for a 1½ in. piston rod on the other end. The piston has a 5 ft. stroke which, with the two 8 in. cast iron pulleys, gives a lift of 10 ft. A ⅜-in. standard chain may be used for hoisting. One end is fastened to the cylinder head and the other has a timber hook fastened in a ring. Six 4 in. cast iron wheels run on the bottom flange of the 12 in. I-beam which

supports the hoist. The air valve and the operating mechanism is located on the air pipe which leads to both ends of the cylinder. The valve operating chains are made long enough for a man to easily reach them from the ground. A ¾-in. air hose is connected to the cylinder, the piping being long enough to reach from one end of the crane to the other.

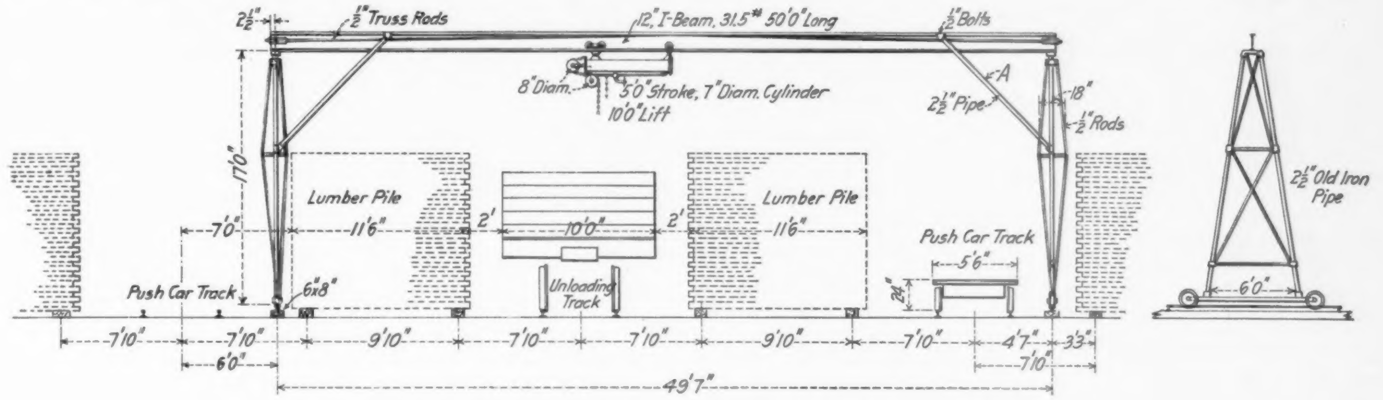


Fig. 6—Traveling Crane With Pneumatic Hoist for Lumber Yard.

SHEAVE FOR TRANSFER TABLE.

In many shops where transfer tables are used to convey the cars from the storage track to the shop, and vice versa, means must be provided to pull them from the table into the shop. This is sometimes accomplished by brute strength, but the sheave and hook shown in Figs. 7 and 8, when used in connection with a wire rope and hoisting drum driven by the engine which operates the table, have been found to be more convenient. With these only two men are required to remove the car from the transfer table. The sheave hook is placed in an eye which is located at the end of the table. A wire rope is secured to the car and passes through the sheave and back to the drum. With a good start the car can usually be "kicked" into the shop.

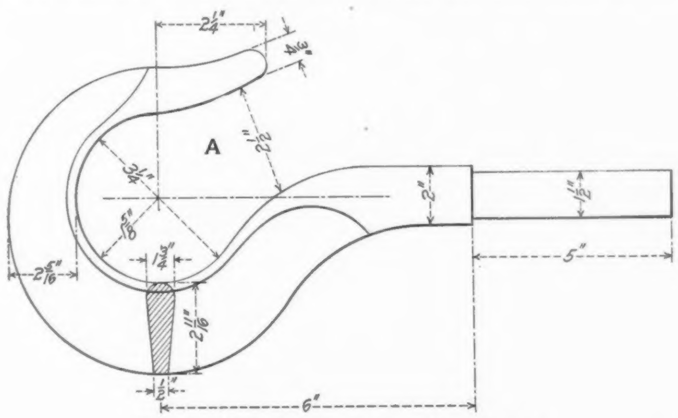


Fig. 7—Hook for Transfer Table Sheave.

The sides of the sheave are made of ¼ in. sheet iron. The bearing pin is 1 in. in diameter, and is held in two iron bars. The bottom bar is ¾ in. x 3 in., and is bent into an L shape, the hook being riveted into this L as shown. The top bar is made of ⅝ in. x 3 in. iron and has a hinge at one end as shown, so that it may be raised to allow the wire rope to be put into the sheave. The sheave wheel is forged from an old car axle and machined to the proper size and shape. The hook *A* is forged from the

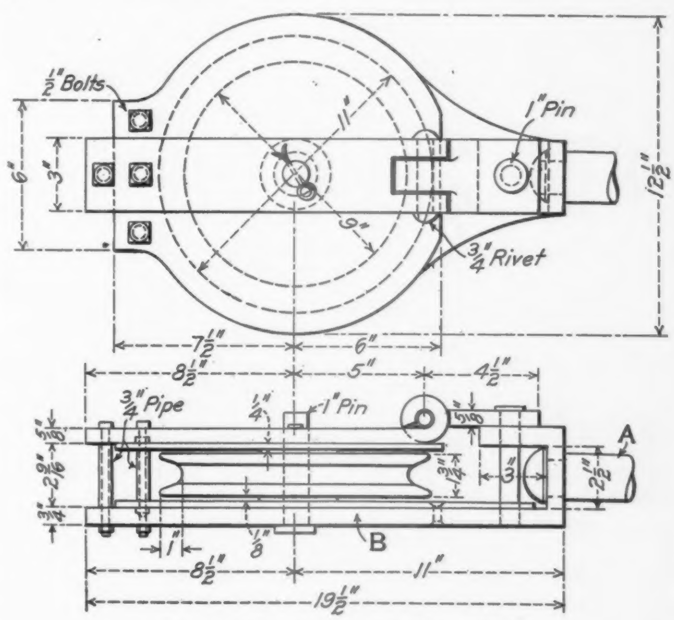


Fig. 8—Sheave for Transfer Table.

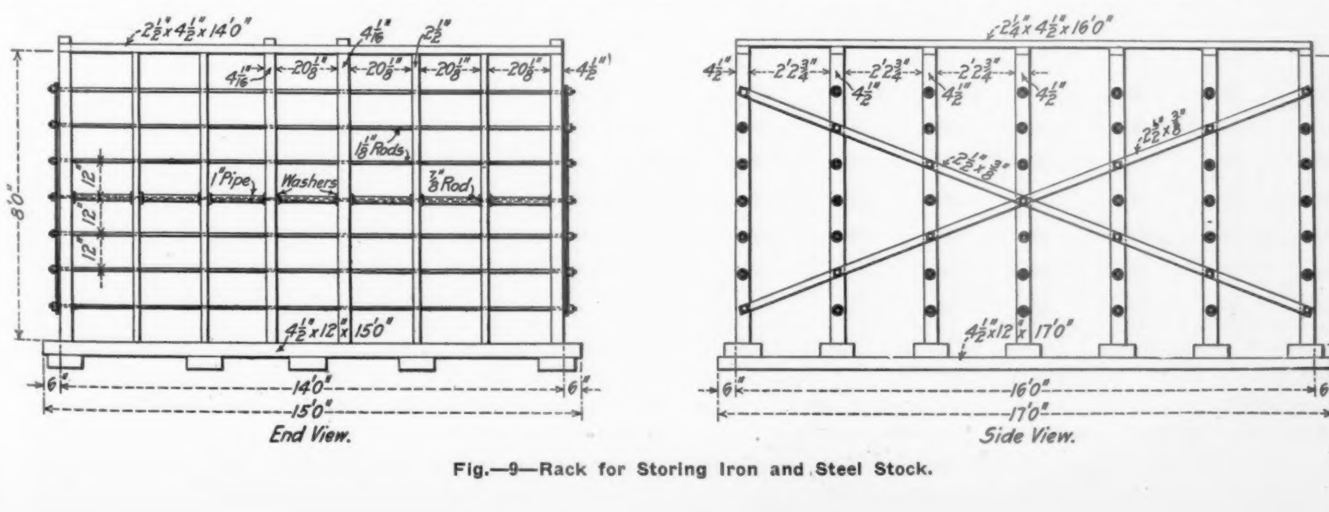


Fig.—9—Rack for Storing Iron and Steel Stock.

same material. The sheave rests on the side *B* while in use, so that the pins will not drop out. It is not so heavy but that one man can easily carry it anywhere about the plant.

IRON STORAGE RACK.

The storage of iron and steel stock is quite a problem in many shops, especially where a large variety of sizes are carried. The rack shown in Fig. 9 will hold 56 different sizes of iron. The framework is made of oak timbers and is bolted together by ⅞ in. tie rods. The tie rods have pieces of a 1 in. pipe with washers slipped over them as they are passed through the members of the framework. The pipes keep the bar iron from wearing the rods. Only one of the rods is shown thus covered in the drawing, but all of them are treated in the same way. The proper size of the iron should be stenciled over each section, and if care is taken in keeping the stock in its proper place it will save the time of measuring. If the rack is placed outside the shop a roof should be built over it to protect the stock from rain and snow. It is far preferable, however, to have the rack inside of the shop.

A CONTRAST

The superintendent of motive power was busily engaged in explaining a detail of the shop organization as we stepped through the doorway leading to the machine and erecting shop. Our quiet entrance into the noisy shop undoubtedly attracted very little, if any, attention until we had advanced some 10 ft. or more into it. At that time, however, things in our end of the big shop seemed to move a little more lively, and the workmen began to work at a faster pace, at least so it seemed from the actions of some of them and the increased noise and din of the shop. Above the noise, however, could be heard a series of low, but penetrating whistles, which seemed to travel down along the shop, and were apparently signals announcing the approach of one in authority. A visitor does not like to be discourteous enough to notice such things, and so I appeared to be busily engaged in examining the finish on a crank pin in one of the driving wheels. However, glancing out of the corner of my eye, I could see a slight flush gradually extending over the face of the superintendent of motive power.

In chatting in his office later in the day I asked permission to take some photographs in the tin shop and to describe the methods which were in use in that shop. The foreman seemed to be a good executive, and, with one of his assistants, had contrived some very ingenious devices which greatly facilitated the work and reduced the cost of production.

"No!" said the superintendent of motive power, "you cannot do it."

"That seems strange," I said, "for you have such a splendid department, and the man in charge is much more capable than the average man holding the same position."

"That is just why I don't want to have you describe it."

Almost unconsciously, I gasped out, "Why?"

"Because, if you were to publish a description of John's work he would get the big head and would want more money. He would become dissatisfied or else some one would come in and offer him more money, and we would either have to raise his salary or lose him."

* * *

The scene is in another shop of about the same size as the one in which the above-mentioned incident took place. As I entered a large door at the end of the machine and erecting shop I was immediately impressed with the fact that the work seemed to be carried on at a good lively pace. I was unaccompanied by any of the mechanical department officials, and the men seemed to pay no attention to my presence. Every department in the large plant seemed to be operated to its full capacity. There was no confusion on the part of the workmen and no loafing was apparent. I learned afterwards that the output of the shop was surprisingly large considering its size.

Naturally I was interested in meeting and studying the shop superintendent in charge, especially since the whole attitude of the men was so entirely different from the shop which I previously visited. One of the first things that he said when I met him was:

"If you have your camera with you, be sure and make good use of it in our blacksmith shop. The foreman and his assistant are doing splendid work, and you will not only secure a splendid article for your readers, but our foremen will be inspired to greater efforts when they see that their work is appreciated, not only by those of us to whom they report, but by the railways at large."

The shop superintendent then drew attention to some of the more important things which were being accomplished in a number of the other departments, and gave much active assistance in helping to get his foremen interested in furnishing all the details about the way in which the various classes of work were being handled.

* * *

The contrast between the two shops was so great that it prompted investigation into the comparative output. It was found that the second shop turned out a considerably larger amount of work with a much smaller number of men. How is your shop or your department being managed, and are you cultivating or killing the best efforts of the men under you?

NEW DESIGN OF PISTON

The accompanying illustration shows a suggestion for fitting the piston rod into the piston head. The object is to eliminate the use of follower bolts and piston rod nuts, because of the difficulties in maintaining them, and at the same time construct a piston at a less cost. When the pressure is on the rear side of the piston it pulls directly against the taper on the rod and when the pressure is on the front side a portion of it acts on the piston head and the remainder on the steel disc, or follower plate. When assembling the piston the piston head may be heated and shrunk on to the taper of the rod. When applying the disc head, rivets should be inserted so that when they cool they

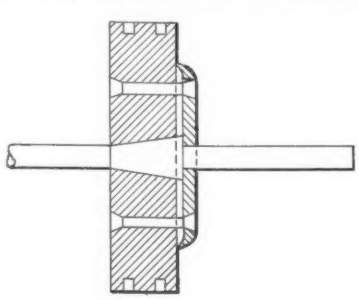


Fig. 1.

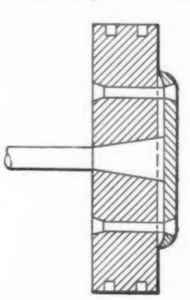


Fig. 2.

Suggestions for Connecting Piston Rods to Pistons.

will pull the plate tightly against the shoulder of the rod, as shown in Fig. 1, or against the end of the piston rod, as shown in Fig. 2. When this disc is fastened in place it is to be caulked down against the piston head, so as to make a non-pressure space between the follower plate and the head. When steam is admitted in the front end of the cylinder the pressure will be transmitted directly to the end of the piston rod through the follower plate, or, in the case of the extension rod, against the shoulder on the rod. This design has not been put in practical use, and J. E. Osmer, master mechanic, Chicago & North Western, Boone, Iowa, to whom we are indebted for this article, would be glad to have any criticisms or comments on the arrangement.

HANDLING APPRENTICES.*

BY WILLIAM G. REYER.

General Foreman, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

An apprentice should be taken on probation for three months and at the end of that time, if he shows the requisite qualifications, should be accepted. In case he does not, he should not be accepted under any consideration. In nine cases out of ten the boy that makes the best mechanic is the one who has nothing but his own energy and nerve to push him along. In selecting apprentices take the one with the quick step, the one who looks you in the face and whose bright eye tells you that he will make good. He may be a little hard to handle at first, but show him you have his interests at heart and that the pranks he is playing, which are constantly getting him into trouble, must be stopped while he is in the shop. Get close to him; show him you are his friend and in the end he will go his length for you and you will find he will make a first-class mechanic. Let your apprentice boys feel they may come to you at any time for advice, not only about the work but with any trouble they may have. Try to gain their confidence, but be firm with them, letting them understand that the shop rules must be obeyed. At the same time do not let the boy feel as though he was going up against an iceberg whenever he approaches you. Have a pleasant word for all of them.

By studying each boy's disposition, you will soon be able to handle him to advantage. Should a boy be brought to you for a reprimand, point out his error; show him how important it is to start right and that he is forming habits which will remain with him through life. Show him that you are interested in his welfare and that to make a success in life he must adhere strictly to the truth and familiarize himself with every detail of his trade. He must also be energetic, at all times striving to do his work in a first-class manner. The boy that works to just make a day's pay, or the boy that thinks he knows more than the instructors, had better be excluded from the shop. If he listens to what the instructor tells him and makes a study of his work, he will find that some day his superior officers will want to place him in a responsible position.

Impress upon your apprentices the importance of study, trying to get them interested in drawing and mathematics. Point out that if they wish to hold any position of importance they must not only be masters of their trade, but must know how to make calculations and read drawings. They must also be able to control themselves. This sounds simple enough, but there are many men who have found the lack of self-control to be a stumbling block. Make each apprentice feel that you are looking to him to help raise the standard of your apprentice course. Pat him on the back once in a while, telling him you appreciate what he is doing. Stop the habit of having a grouch. A pleasant word and a smile will go farther in one day than all the cussing you can do in a week.

Mechanics and Handy Men.—In handling the men make a study of each one. Some you will find more adapted to one class of work, while others are all right wherever you put them. If a man is kept on the kind of work he takes the most pride in doing, he will soon be setting a pace for the other fellow to follow. Some men may as well be discharged at once for doing poor work or for violating the shop rules, while others, if you take the matter up with them in the proper spirit, and if they have any consideration of the company's interests will endeavor to improve and strive to increase the shop output. Let each one know that you are his friend, but that he must do his part or you cannot hold him. It is important that the men be made as comfortable as possible. If the shop is kept in a good sanitary condition, and is provided with lockers and the necessary tools, you will find that the men will be better satisfied, and when they are satisfied they will do more work. Let the men know you have a system and make them work by it. If they are allowed to do a job any old way the shop force will become demoralized, the standard will be lowered, and the output will decrease.

Handy men are started in the erecting shop stripping engines, and are soon able to help the machinists. After some experience they will be able to do such work as reaming holes, tightening steam chests, applying cylinder heads, grinding steam pipe rings and applying steam pipes. A foreman must be governed by the class of men and boys under him; he cannot use the same methods when handling foreigners as he would with American workmen. Study the class of men that work for you and treat them as you would like to be treated.

*Entered in the *Railway Age Gazette* competition on the Instruction of Workmen and Apprentices, which closed April 15, 1911.

QUICK RETURN CRANK SHAPER MOTION

A criticism of the value of the quick return mechanism of the Stockbridge shape appeared in the November, 1911, issue of the *American Engineer and Railroad Journal*. In replying to this, the Stockbridge Machine Company, Worcester, Mass., has presented the following statement:

"The writer of the criticism of our shaper says of the shape which he advocates: 'We use the simple form of quick-return mechanism, Fig. 1.' The simple quick-return referred to is actually only a small increase in the return stroke due to the

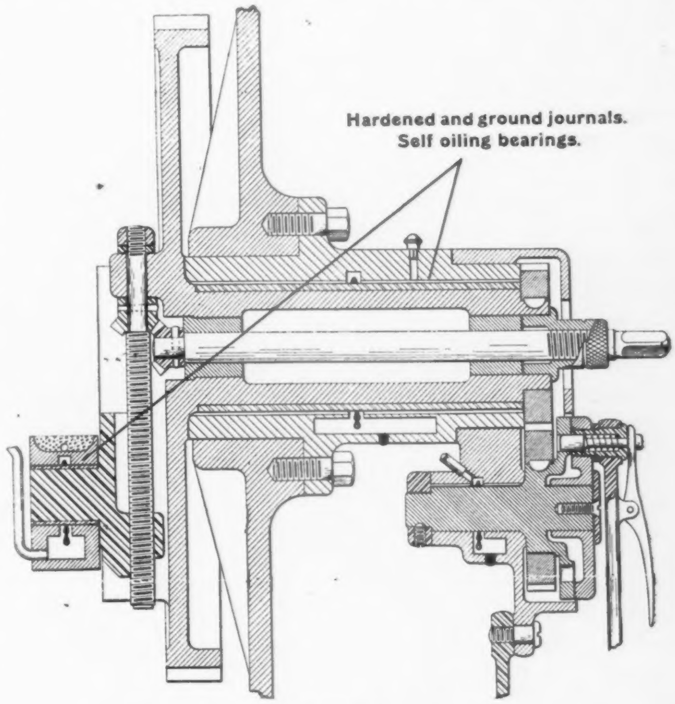


Fig. 1—Simple Quick Return Mechanism.

inclined position of the rocker arm when the shaper is on its longest strokes. As the length of stroke is shortened, this increased speed of return is cut down very rapidly as the rocker arm approaches more nearly a vertical position. The quick return of a regular crank shaper when on a stroke less than one-half its full length stroke is so small that for all practical purposes it may be neglected. An actual quick-return motion, however, is of the greatest value on the shorter strokes. The Stockbridge two piece crank motion maintains this quick-return even down to a 1-in. stroke.

"Attention is directed to the fact that in the regular crank shaper there is only one bearing surface for the bull gear. Compare the unsupported gear, Fig. 1, with the construction shown in Figs. 2 and 3, where it will be noted that the gear is given a bearing on its periphery. With this construction all strain and the

consequent friction is taken off of the crank hub, and it is practically free from wear. The advantage of our construction over that shown in Fig. 1, with the small diameter hub compared with diameter of gear, is too evident to need comment. The amount of friction in this connection can only be determined by tests. The question of the number of bearings does not seem to be so important a factor in friction as the rigidity of the parts and the way in which they are supported against cramping. The friction of stiff, free running parts is a small matter compared to the friction troubles due to too much over-hang or to any other defect in design that allows spring or cramping. Our main bearing support for the bull gear, Figs. 2 and 3, eliminates all possibility of spring or cramping.

"In the following table are given the results of some tests made by H. P. Fairfield of the Worcester Polytechnic Institute. To make a fair comparison every condition must be identically the same and Mr. Fairfield in his tests made use of the same machine, turning it into a regular crank shaper, by simply bolting the crank and the gear together, eliminating all the parts which made up the two piece crank.

Depth of Cut. In.	Length of Cut. In.	Feed per Cut. In.	Cutting speed. Feet per minute.	Stockbridge two piece crank. Horse power.	Regular crank. Horse power.
3/8	12	0.0294	15	2.10	3.08
3/8	12	0.0294	17	2.68	3.35
3/8	12	0.0294	25	3.22	3,62
3/8	12	0.0294	30	4.02	4.16

"In the first place, tests were made with the two piece crank and about 25 readings were made for each test, and an average taken; then the gear and the crank of the same shaper were bolted together, making a regular crank shaper. In other words, in the latter test the friction of the sliding blocks and the extra bearing surfaces of the two piece crank shaper were eliminated. These tests prove beyond doubt that if there is any added friction because of the two piece crank parts it is more than made up by the gain of power through the use of the two piece crank.

"The parts which are actually required to make up the two piece crank are (Fig. 4) the eccentric *C*, eccentric ring *E*, two blocks *A* and *B*, gear *F*, and crank *G*. One of these parts, the gear *F*, is, of course, used in both constructions. From Fig. 2 it will be noted that the assembled parts are just as compact as a regular crank. The extra parts used are not numerous or complex, and we know that the advantages obtained are altogether out of proportion to the disadvantages due to the cost of the few extra parts required.

"That it does produce the results claimed, your correspondent freely admits; however, the motion does not seem to be fully understood by him judging from further remarks in regard to the accelerated motion of the Powell planer. He draws the inference that if the accelerated motion of the Powell planer is an advantage, then the even cutting speed which we get is not. A study of the velocity curve in the October issue of the *American Engineer and Railroad Journal*, page 416, will show that what we accomplish is practically what Mr. Powell accomplishes in his accelerated motion. The velocity starting at zero increases gradually, but does not come up to full speed, on the length of stroke shown, until it has traveled about 2 in., and as ¾ in. is all that is required for tool clearance, it will be seen that the tool strikes into the work at a slow speed, comes up to its maximum and maintains that speed until it reaches nearly the end of the stroke where it drops off gradually, accomplishing practically what the Powell motion does on a planer.

"Your correspondent states: If the quick-return is so important, why the variable speed planer with the constant return? The comparison is misleading and hardly fair. In the construction of the planer the thing that has been worrying designers is to get a number of forward or cutting speeds. The shaper already has the varying forward speeds. The constant speed return of the planer is the maximum speed at which the table can be returned. This is just what we are aiming at in our two piece crank motion, to return the ram at the fastest possible speed at which it can be returned, returning it as near a constant speed as possible. It makes no difference whether the stroke is 2 in. or 24 in., the Stockbridge crank motion maintains a uniform speed of return.

As an illustration of how much work can be produced in a given time and at what expenditure of power under the different conditions given by the simple crank motion and the Stockbridge, the following is offered: Consider a 24 in. shaper on an 8 in. stroke, 40 strokes per minute. The regular crank shaper on this length stroke would have no quick return; with the Stockbridge two piece crank there is a return ratio of, say, 2:1 (actually a little more). Each complete revolution of the gear

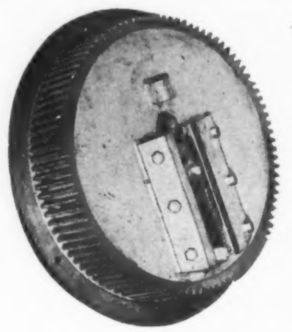


Fig. 2—Bull Ring.

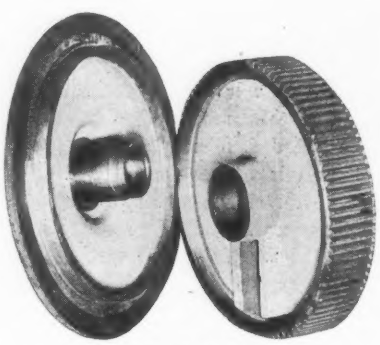


Fig. 3—Bull Ring.

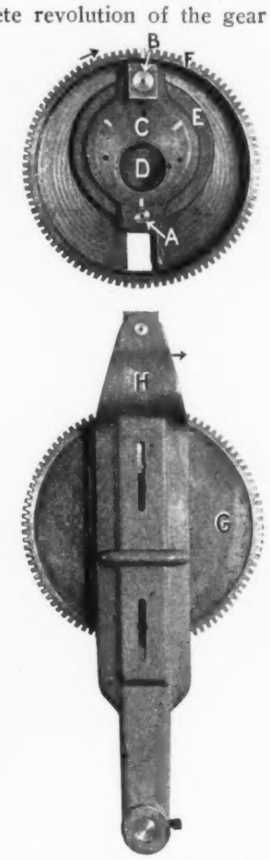


Fig. 4—Two-Piece Crank.

then takes 1½ sec. The regular crank uses ¾ sec. on the cutting stroke and ¾ sec. on the return stroke for each revolution of the gear. The Stockbridge uses 1 sec. on the cutting stroke and ½ sec. on the return stroke for each revolution of the gear. The rate of regular crank tool movement over the work per second equals $8 \times \frac{4}{3} = 10\ 2\text{-}3$ in.; and the cutting speed equals

$$\frac{32}{3} \times \frac{60}{12} = 53\ 1\text{-}3 \text{ ft. per minute.}$$

"The rate of Stockbridge tool movement over the work per second is 8 in., and the cutting speed is $8 \times \frac{60}{12} = 40$ ft. per minute.

"Then, if at a given cut and feed the cutting tool will stand 53 1-3 ft. per minute on an 8 in. stroke with the regular crank shaper, with no quick return, one of three gains can be made with the Stockbridge shaper on the basis of the figures above. First, the length of the stroke can be increased to 10 2-3 in. and still maintain the same cutting speed. Second, the number of cutting strokes per minute can be increased to 53 1-3 and still maintain the same cutting speed. Third, a larger cut or feed can be used (more stock removed) and still maintain the same number of strokes of the ram with no more power used."

General News Section

The number of emigrants arriving at the port of New York during the present year is expected to total not over 800,000, probably 30 per cent. less than the number arriving in 1910.

The number of miles of new main line built in United States during 1911, according to the *Railway Age Gazette,* was 3,066, as compared to 4,122 for 1910. This is the smallest figure since 1897, when 2,109 miles was added.

The Canadian Pacific has decided to adopt oil as a fuel on its line through the Rocky mountains between Kamloops and Field in the province of British Columbia. Arrangements are being made to make this change in the spring.

After mediation by the United States Commissioner of Labor, Dr. Charles P. Neil, the southern lines of the Queen & Crescent have granted an increase of wages to locomotive enginemen of approximately 10 per cent. for passenger runners and 7 per cent. for freight.

The Pennsylvania Company has agreed to a rule promulgated by the state railway commission of Indiana that when a conductor or engineman has to run over a division which he has not traversed for 60 days, he shall make a trip of inspection over the division before taking charge of a train or engine.

The shops of the Reid Newfoundland Company, at St. Johns, N. F., have turned out complete a new locomotive, complete passenger equipment, and two first-class sleeping cars. It is the company's intention to continue building its own engines and cars. This was the first engine built in that colony and was turned out on September 2.

E. A. Miller, superintendent of motive power of the Nickel Plate, has been elected president of the Veteran Association of that road. A veteran is one who has been in the service of the road 25 years. The oldest can have served only a little longer than that, as the road has been in operation only twenty-nine years. It now has over 300 members.

The Pennsylvania Lines have recently built 10 all-steel dining cars at the Altoona shops, which are to be used on the Pennsylvania Special, the Manhattan Limited and other expresses between Chicago and Pittsburgh. Platforms and vestibules have been omitted in these cars, allowing room for a larger kitchen and for 36 seats instead of the usual 30.

Nine locomotives were destroyed at Houlton, Me., December 20, in a fire which burned the engine house of the Bangor & Aroostook. Five locomotives were removed before the flames made it impossible to enter the structure. The blaze started from an unknown cause in a small office connected with the engine house, and both buildings were destroyed.

The State Tax Board of Indiana, having taxed refrigerator and other cars which pass through the state, but which are owned by shippers in other states, has encountered the usual remonstrances from the owners. Investigating the conditions of one Illinois concern, the Board finds that while the length of the railways owned by this car owner is only 7,850 ft., the cars owned by it aggregate a length of 15,750 ft.

On Saturday, December 9, the Los Angeles Limited on the Union Pacific was run from North Platte, Neb., to Omaha, 291 miles, in 300 minutes. The train arrived in North Platte three hours late, and the fast run was made that a sick woman might reach a hospital in time for a surgical operation. Five stops averaging 6 minutes each were made. Deducting this time from 300 minutes, the running time was 270 minutes.

All records for excessive rainfall for short periods on the Isthmus of Panama were broken at Porto Bello on the night of November 28-29, when 2.46 in. of rain fell in 3 minutes, between 2:07 and 2:10 a. m. The highest previous records of excessive rainfall were 0.75 in. in 5 minutes at Rio Grande in July, 1908, and 1.24 in. in 10 minutes at Balboa in August, 1908. The total rainfall in the shower at Porto Bello was 7.60 in.

The number of locomotives ordered during 1911, according to the *Railway Age Gazette,* was 2,850. That paper began keeping this record in 1901, and this is the smallest number ordered in any year since then, except 1904 and 1908. The number of passenger cars ordered was 2,623, which has been exceeded in 6 of the 10 years, since and including 1901. The number of freight cars ordered in 1911 was 133,117, which is the smallest number ordered in any year since 1901, except 1903 and 1908.

Statistics compiled by the *Railway Age Gazette* show that the number of cars and locomotives actually *built* during 1911 was smaller than the average for the past ten or twelve years, and in the case of freight cars was actually less than for any year during which that paper has made these compilations. It has received reports from the principal car and locomotive builders in the United States and Canada, and its investigation indicates that the total number of freight cars built during 1911 was 72,161; passenger cars, 4,246, and locomotives, 3,530. The figures for 1910 were: Freight cars, 180,945; passenger cars, 4,412; and locomotives, 4,755.

The number of passenger trains run on the steam railways of the state of New York for the month of October was 63,265, according to the report of the Public Service Commission. Of this number 84 per cent. were on time at the division terminals. The average delay for each late train was 23.8 minutes, and the average delay for each train run was 3.7 minutes. The principal causes of delays were: Waiting for trains on other divisions, 35.0 per cent.; waiting for train connections with other railways, 14.2 per cent.; train work at stations, 13.0 per cent.; trains ahead, 7.7 per cent.; engine failures, 6.2 per cent.; meeting and passing trains, 6.0 per cent.; wrecks, 4.7 per cent.

INCREASING SAFETY

R. C. Richards, general claim agent and chairman of the Central Safety Committee of the Chicago & North Western, described the organization and operation of the safety committee system, as worked out on the North Western during the past year, in an address before the Industrial Safety Conference. He said in part:

"There are now about 500 officers and men serving on these safety committees, and if Benjamin Franklin's old saying that the eyes of the master can do more work than both of his hands is true, surely 500 pairs of eyes trained to look for defective conditions and practices can do more work than the eyes of one person, and from the results that have been attained for the last eleven months (during which time the earnings of the company decreased less than 2 per cent.) this effort to bring about greater safety shows a wonderful improvement in matter of cleaning up yards, station platforms, shops and engine houses of obstructions, cleaning windows, putting up railings at dangerous places, and covering gearing of machines, which has not only brought about greater safety of operation, but also more efficient operation, and we also show the following reductions in our accident record:

47 per cent. in trainmen killed.
40.8 per cent. in trainmen injured.
30.7 per cent. in switchmen killed.
18.5 per cent. in switchmen injured.
50 per cent. in stationmen killed.
10.5 per cent. in stationmen injured.
32 per cent. in trackmen injured.
34 per cent. in bridgemen killed.

11.4 per cent. in shop and roundhouse men injured.
85 per cent. in car repairers and inspectors killed.
70 per cent. in passengers killed.
10 per cent. in passengers injured.
Total reduction of 17 employees killed.
Total reduction of 2,144 employees injured.

The same safety organization as that adopted by the North Western has since been put into effect on the Delaware, Lackawanna & Western, the Elgin, Joliet & Eastern, the Baltimore & Ohio, and the Frisco system.

LOCOMOTIVE PERFORMANCE SHEET

Included in the papers for the fourth annual convention of the International Railway Fuel Association will be one on a Standard Locomotive Fuel Performance Sheet, by Robert Collett, superintendent locomotive fuel service, Frisco Lines, Springfield, Mo. In order to facilitate preparation of this paper, Mr. Collett has sent out a circular requesting answers to the following questions: Does your company make up a fuel performance sheet? If so, what is the nature of it—daily or monthly, or both? If a performance sheet is kept, is it an individual engine or engineer's record of fuel consumed? Which of the two methods do you prefer and should it in your opinion be a daily or monthly record? Give reasons. What is your opinion with reference to separating charges for fuel used at terminals from that used on the trip? What methods are used to interest enginemen in their fuel performance? Please give your opinion or experience with weighing devices and coal chutes and whether or not you consider it advisable to incur the expense of installing scales at mechanical chutes and incurring the extra help needed at mechanical chutes. What methods do you recommend for taking care of the shortage between coal chute measurements and billed weights?

MEETINGS AND CONVENTIONS

The nineteenth annual convention of the Air Brake Association will be held at Richmond, Va., May 7-10, 1912.

It has been decided to hold the 9th annual meeting of the Railway Storekeepers' Association at Buffalo, N. Y., on May 20, 21 and 22, 1912. In addition to the committee on recommended practices, committees have been appointed on piece work, scrap classification, accounting, uniform grading and inspection of lumber, standard grain doors, stationery, standardization of tin ware and membership.

At a meeting of the executive committee of the International Railway General Foremen's Association which was held in Chicago, December 18, it was decided to hold the next annual convention July 23, 24, 25 and 26, 1912. The following subjects will be discussed: How Can Shop Foremen Best Promote Shop Efficiency; Shop Supervision and Local Conditions; Shop Specialization, Tools and Work; Engine House Efficiency; Reclaiming Scrap Material, and The Relation of Tests to Shop Efficiency.

At the November meeting of the Western Canada Railway Club, A. A. Hopkirk, shop engineer of the Canadian Northern at Winnipeg, presented a paper in which he clearly pointed out the fact that most railway shops do not begin to obtain the full benefits of high speed tool steel. Many of the reasons for this condition are controllable and correctable. Mr. Hopkirk devoted most of his attention to the proper methods of forging the tools and the proper shapes to which they should be ground. With the properly formed tool in use on a machine of sufficient strength and rigidity, it was stated that locomotive driving axles could be turned at a cutting speed of 63 ft. per minute with a ¾ in. depth of cut and ⅛ in. feed.

At the November meeting of the Central Railway Club, F. M. Whyte drew attention to the problem of determining the best mediums for furnishing instructions and information and the best method of distribution to the various members of large organizations. His ideas on the phases of the subject discussed were summarized in the last paragraph, in which he stated that the adoption of standards would be found to be most important as a beginning. Circular letters are a convenient medium, but they should be revised frequently and re-issued. Traveling representatives are valuable, but they should be teachers, not doers. In the discussion, which was very active and interesting, one member drew attention to the great importance of having instructions cover every possible detail, so that the man receiving them would only have to act and not surmise what the idea of the writer might have been or to ask questions. Along this same line Mr. Whyte, in his closing remarks, drew attention to the danger of the man preparing the instructions, knowing too much on the subject and assuming that others are better acquainted with it than is actually the case, in this way not making the instructions sufficiently clear.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.; annual, May 7-10, Richmond, Va.

American Railway Master Mechanics' Assoc.—J. W. Taylor, Old Colony building, Chicago. Convention, June 17-19, Atlantic City, N. J.

American Railway Tool Foremen's Association.—M. H. Bray, N. Y., N. H. & H., New Haven, Conn.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York.

Car Foremen's Association of Chicago.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in Month, Chicago.

International Railway Fuel Association.—D. B. Sebastian, La Salle St. Station, Chicago.

International Railway General Foremen's Association.—L. H. Bryan, Brown Marx building, Birmingham, Ala. Convention, July 23-26, 1912.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio. Convention, August 15, Chicago.

Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York; annual convention, May 14-17, Pittsburgh, Pa.

Master Car Builders' Association.—J. W. Taylor, Old Colony building, Chicago. Annual convention, June 12-14, Atlantic City, N. J.

Master Car and Locomotive Painters' Assoc. of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass. Convention, 2d week in September.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio. Convention, May 20-22, Buffalo, N. Y.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y., August, 1912.

RAILROAD CLUB MEETINGS

Club.	Next Meeting.	Title of Paper.	Author.	Secretary.	Address.
Canadian	Jan. 9	Transportation	U. E. Gillen	Jas. Powell	Room 13, Windsor Hotel, Montreal.
Central	Jan. 11	Tonnage Rating of Locomotives	Prof. E. C. Schmidt.	H. D. Vought	95 Liberty St., New York.
New England	Jan. 9	Railway Signaling	J. M. Fitzgerald	Geo. H. Frazier	10 Oliver St., Boston, Mass.
New York	Jan. 19	Self-Propelled Motor Cars	W. B. Potter	H. D. Vought	95 Liberty St., New York.
Northern	Jan. 6	Lubrication	W. W. Breckenridge.	C. L. Kennedy	[illegible]01 Superior St., Duluth, Minn.
Pittsburgh	Jan. 26	Oxy-Acetylene Welding and Cutting	J. A. Warfel	J. B. Anderson	Union Station, Pittsburgh, Pa.
Richmond	Jan. 12	Relation of the Technical College to the Railroads	Prof. L. S. Randolph.	F. O. Robinson	C. & O. Ry., Richmond, Va.
S'th'n & S. West'n	Jan. 18	Superheaters		A. J. Merrill	218 Grant Bldg., Atlanta, Ga.
St. Louis	Jan. 12	The Telautograph; Its Uses and Possibilities	H. J. Woods	B. W. Frauenthal	Union Station, St. Louis.
Western	Jan. 16	Head End Electric Train Lighting	C. R. Gilman	Jos. W. Taylor	[illegible]0 Old Colony Bldg., Chicago.

PERSONALS

H. ELLET has been appointed assistant engine house foreman of the Rock Island Lines at Valley Junction, Ia.

J. F. SHEEHAN has been appointed master mechanic of the Georgia & Florida, with office at Douglas, Ga.

ALFRED BURG has been appointed foreman of the car department of the Lake Shore & Michigan Southern at Buffalo, N. Y.

JOHN BLACKBURN has been appointed foreman of the machine shop of the New York Central & Hudson River at Depew, N. Y.

L. H. RAYMOND has been appointed superintendent of shops of the New York Central & Hudson River at Depew, N. Y.

B. F. STONE has been appointed assistant general foreman of the New York Central & Hudson River at the Depew, N. Y., shops.

JOHN PARSONS, assistant general foreman of the New York Central & Hudson River, at Depew, N. Y., has been promoted to general foreman.

J. Q. LALOR has been appointed division storekeeper of the Union Pacific, with office at Denver, Colo., succeeding George Wheadon, resigned.

C. B. GRAY, assistant general foreman of the Pitcairn, Pa., shops of the Pennsylvania Railroad, has been appointed general foreman at Enola, Pa.

J. M. HENRY, master mechanic of the Pennsylvania Railroad at Olean, N. Y., shops, has been appointed master mechanic of the West Philadelphia shops.

W. J. RUSLING, general foreman of the Enola, Pa., shops of the Pennsylvania Railroad, has been appointed master mechanic of the Elmira, N. Y., shops.

C. D. PORTER, foreman of the Park shops of the Pennsylvania Railroad at Philadelphia, Pa., has been appointed assistant general foreman at Pitcairn, Pa.

J. B. KAPP, assistant general foreman of the Pennsylvania Railroad tank shop at Altoona, Pa., has been appointed foreman of the Park shops at Philadelphia.

ROBERT LEATON, boiler inspector of the Atchison, Topeka & Santa Fe at Cleburne, Tex., has been appointed foreman of the new shops at Sweetwater, Tex.

J. J. MCNEILL has been appointed supervisor of locomotive operation of the Erie Railroad, with office at Cleveland, Ohio, succeeding D. J. Madden, promoted.

C. K. SHELBY, master mechanic of the Elmira, N. Y., shops of the Pennsylvania Railroad, has been transferred as master mechanic to the Olean, N. Y., shops.

FRANK STRIEBER, foreman of heavy repairs at the Ashtabula, Ohio, engine house of the Lake Shore & Michigan Southern, has been promoted to assistant general foreman.

C. W. ASHMAN has been appointed night roundhouse foreman of the Rock Island Lines at Cedar Rapids, Ia., succeeding J. Vlasak, who has been assigned to other duties.

D. J. MADDEN, supervisor of locomotive operation of the Erie Railroad at Cleveland, Ohio, has been appointed trainmaster of the Chicago and Hammond terminals of that road.

D. H. WATSON, general foreman in the locomotive department of the Baltimore & Ohio at Garrett, Ind., has been placed in full charge of the operation of the shops at Garrett.

N. WANAMAKER, general foreman of the locomotive department of the New York Central & Hudson River at Depew, N. Y., has been appointed superintendent of shops at that place.

GEORGE W. WEBER, locomotive foreman of the Great Northern at Great Falls, Mont., has been promoted to traveling engineer on the Butte division, with headquarters at Great Falls.

H. S. HAYWARD, superintendent of motive power of the New Jersey division of the Pennsylvania Railroad, at Jersey City, N. J., has been appointed consulting engineer of floating equipment.

LUKE CONNORS, assistant general foreman of the Lake Shore & Michigan Southern engine house at Ashtabula, Ohio, has been appointed general foreman of the engine house at Ashtabula, Ohio.

M. C. M. HATCH, chief draftsman of the Boston & Maine, Boston, Mass., has been appointed engineer of tests of the New York, New Haven & Hartford and the Boston & Maine, with office at Boston.

G. E. SISCO, assistant master mechanic of the Pennsylvania Lines West of Pittsburgh, has been appointed assistant engineer of motive power, with office at Columbus, Ohio, succeeding H. S. Needham, transferred.

J. M. JAMES, master mechanic of the West Philadelphia shops of the Pennsylvania Railroad, has been appointed superintendent of motive power of the Western Pennsylvania division, with headquarters at Pittsburgh, Pa.

JOHN H. MASON has been appointed road foreman of engines of the Lehigh Valley and Susquehanna division of the Central Railroad of New Jersey, with office at Mauch Chunk, Pa., succeeding A. B. Enbody, promoted.

D. M. PERINE, superintendent of motive power of the Pennsylvania Railroad at Pittsburgh, Pa., has been transferred to the New Jersey division as superintendent of motive power, with headquarters at Jersey City, N. J.

S. T. ARMSTRONG, foreman of the erecting shop of the International & Great Northern, at Palestine, Tex., has been made general foreman of the shops at that point. W. E. Gray has succeeded him as erecting shop foreman.

J. T. WALLIS, superintendent of the West Jersey & Sea Shore, has been appointed general superintendent of motive power of the Pennsylvania Railroad, with office at Altoona, Pa., succeeding R. N. Durborow, deceased.

P. F. SMITH, JR., master mechanic of the Pennsylvania Lines West, at Columbus, Ohio, has been appointed superintendent of motive power of the new Central system, which comprises the Cleveland, Akron & Cincinnati, and the Toledo, Columbus & Ohio River.

J. W. SMALL, superintendent of machinery of the Missouri Pacific at St. Louis, Mo., has been appointed superintendent of motive power of the Southern Pacific Lines in Texas, with office at Houston, Tex., succeeding J. J. Ryan, deceased.

H. C. NEEDHAM has been appointed master mechanic of the Southwest system of the Pennsylvania Lines West, with office at Richmond, Ind., succeeding J. W. Hopkins, general foreman at that place; the title of general foreman has been abolished.

F. V. MCDONNELL, master mechanic of the Northwest system of the Pennsylvania Lines West, at Mahoningtown, Pa., has been appointed master mechanic of the Southwest system, with office at Logansport, Ind., succeeding J. F. Walsh, transferred.

J. T. ANDRUS, purchasing agent of the Oregon-Washiugton Railroad & Navigation Company at Spokane, Wash., having resigned and his position having been discontinued, the purchases for that division are made by R. Koehler, general purchasing agent, with office at Portland, Ore.

JOHN PULLAR, division foreman of the Atchison, Topeka & Santa Fe at Los Angeles, Cal., has been appointed master mechanic, with office at Richmond, Cal., succeeding E. H. Harlow,

appointed terminal master mechanic of the San Francisco Bay terminals, with office at Richmond.

C. H. Hogan, assistant superintendent of motive power of the New York Central & Hudson River at Albany, N. Y., has been appointed assistant superintendent of motive power of the Eastern district (Hudson, Harlem, N. Y. & P., River, Mohawk and Adirondack divisions) with headquarters at Albany.

A. J. Fries, district superintendent of motive power of the New York Central and Hudson River at Depew, N. Y., has been appointed assistant superintendent of motive power of the Western district (Buffalo, Rochester, Western, Ontario, St. Lawrence and Pennsylvania divisions) with headquarters at Depew.

J. F. Bowden, master mechanic of the Baltimore & Ohio, at Garrett, Ind., has had his jurisdiction extended and is now in charge of the Chicago division and the Northwest system, the latter including the Baltimore & Ohio Chicago Terminal. G. A. Schmoll, who has been superintendent of motive power of the lines west of the Ohio river, now has jurisdiction over the Wheeling system only.

C. E. Copp, master painter, Boston & Maine, has been transferred to the Concord shops, Concord, N. H., where he will have charge of the locomotive and car painting. Warner Bailey, who previously had charge, has been assigned to other duties. Mr. Copp won the first prize in the recent competition on Paint Shop Practice, his paper being published in the *Railway Age Gazette* of December 1, 1911, page 1109.

C. W. Cross, superintendent of apprentices of the New York Central Lines, with office at New York, will report to C. E. Schaff, vice-president of the New York Central Lines, after January 1, and will have his office in the La Salle street station, Chicago. His jurisdiction will extend over the New York Central Lines west of Buffalo only. Henry Gardner, now assistant superintendent of apprentices at New York City, will be in charge of the apprenticeship work on the New York Central & Hudson River, and will report to R. T. Shea, general inspector of piece work.

W. W. Scott, formerly superintendent of shops for the Cincinnati, Hamilton & Dayton at Morefield, Indianapolis, Ind., has been appointed shop superintendent of the Pere Marquette at Saginaw, Mich., vice C. K. Woods, resigned. Mr. Scott was born in Chicago and served as a machinist apprentice with the Grand Rapids & Indiana at Grand Rapids, Mich. He worked at the Fort Wayne shops of the Pennsylvania Lines West of Pittsburgh as a machinist, and after leaving there went with the Bucyrus Steam Shovel & Dredge Company at Bucyrus, O., remaining with that company until after the removal of its plant to South Milwaukee, Wis. For three years he was editor and manager of the *South Milwaukee News*, and in 1901 again entered the service of the Grand Rapids & Indiana as a machinist. Following this he was night machine foreman with the Pere Marquette at Grand Rapids, Mich., and master mechanic of the Kalamazoo, Lake Shore & Chicago. The latter road, being small, did not offer many opportunities for promotion, and he entered the service of the Cincinnati, Hamilton & Dayton at Indianapolis, Ind., as general foreman, later being promoted to the position of shop superintendent. Mr. Scott is an active member of the International Railway General Foremen's Association, and was elected a member of the Executive Committee at its last convention.

W. W. Scott.

OBITUARY

James Doyle, master car builder of the Pullman Company, Chicago, died in Detroit, Mich., on December 3, at the age of 57. He had been with the Pullman Company 36 years.

Richard N. Durborow, general superintendent of motive power of the Pennsylvania Lines east of Pittsburgh, Pa., and Erie, with office at Altoona, Pa., died of heart disease at Philadelphia on December 9. Mr. Durborow was born in Philadelphia, April 10, 1860, and was educated at Cheltenham Academy and Maryland Military Institute. He entered the service of the Pennsylvania Railroad in February, 1879, as an apprentice in the West Philadelphia machine shops. In September of the following year he was transferred to Altoona, and upon the completion of his apprenticeship entered the mechanical engineer's department. In March, 1890, he was appointed inspector in the West Philadelphia car shops, and in October, 1892, was made assistant general foreman of the same shops. He was promoted to acting master mechanic in November, 1895, and the following March became master mechanic at the West Philadelphia shops. On May 15, 1900, he was promoted to superintendent of motive power of the Philadelphia, Baltimore & Washington, and the following August was made superintendent of motive power of the Buffalo & Allegheny Valley division. In October, 1901, he was appointed superintendent of motive power at Altoona, and on June 28, 1911, was made general superintendent of motive power at Altoona. Out of respect to the memory of Mr. Durborow, all the shops of the Pennsylvania Railroad in Altoona, as well as a number of business houses, were closed December 11, the day of his funeral.

R. N. Durborow.

Samuel Brown, a retired master painter of the New York, New Haven & Hartford, recently died at his home in Quincy, Mass., at the age of 69. Mr. Brown was an honorary member of the Master Car and Locomotive Painters' Association, and a member of Paul Revere Post 88, G. A. R.

James M. Root, who died at his home in New York City this week, at the age of 67, was a hero of the forest fires in Minnesota in the summer of 1894. On August 31, Root was engineer of a passenger train on the St. Paul & Duluth, running from Duluth south. The fires had wiped out Hinckley and other towns. Root's train was crowded with passengers. When he was unable to proceed further he ran the train back seven miles through dense smoke to a small swamp where the passengers escaped the flames by submerging their bodies in the water. Root himself was badly burned and nearly suffocated.

NEW SHOPS

ATCHISON, TOPEKA & SANTA FE.—A new twelve-stall engine house is being contemplated for erection at East Hutchinson, Kan. A contract has been given to the Sharp & Fellows Contracting Company, Los Angeles, Cal., for constructing reinforced concrete engine houses at Calwa and at Riverbank. The houses are to have 15 stalls and will be so arranged that in future the capacity can be increased to 45 stalls. A site has been acquired at Peoria, Ill., for a terminal, at which point it is understood that shops will be built.

ATLANTIC COAST LINE.—This road is planning the erection of car repair shops and other buildings at Thomasville, Ga. A roundhouse, shop building, etc., will be erected.

BALTIMORE & OHIO.—A contract has been awarded to M. P. Wells, Philadelphia, Pa., to construct a coal tipple, sandhouse, ash pit, storeroom and oilhouse in the yards at Cumbo, W. Va. The cost will be about $90,000.

CANADIAN PACIFIC.—It is announced that the contract for the shops at Calgary was let by Vice-president Bury to the Westinghouse, Church, Kerr Company, New York. It will commence work on the new buildings at once, and is to have them finished by the end of next year. They will be of the same size as the Winnipeg shops.

DELAWARE & HUDSON.—This company will complete in July, 1912, a modern locomotive and car repair shop at Watervliet, N. Y., at a cost of approximately $2,000,000. The shop lay-out also provides for a large modern enginehouse and car-cleaning facilities. A portion of these will be available in January, 1912. During the last five years the Delaware & Hudson has spent in the neighborhood of $17,000,000 for new equipment without making any expensive enlargement of its shop facilities, and the new shop is to take care of the needs on this account.

GRAND TRUNK.—It is reported that the capacity of the car shops at Port Huron, Mich., will be doubled.

MEXICO & NORTH WESTERN.—New shops are being installed at Chihuahua, Mex. It is also proposed to erect a new engine house.

NEW YORK CENTRAL LINES.—It is stated that plans are being made to erect a large plant at some point in Ohio for the repair of steel cars. The site has not yet been selected.

NEW YORK, NEW HAVEN & HARTFORD.—Contracts are being let for a repair shop, paint and oil house, power house, and other shop buildings at Van Nest, N. Y.

PENNSYLVANIA LINES WEST.—It is reported that this company is considering the location of yards and shops near Chicago.

PHILADELPHIA & READING.—This road is preparing to build a 40-stall roundhouse at Mill Creek, Pa.; it will be 400 feet in diameter.

PULLMAN COMPANY.—It is reported that a new addition will soon be erected to the car shops near Richmond, Cal.

SALEM, FALLS CITY & WESTERN.—A number of improvements are being planned for the shops at Dallas, Ore.

SOUTHERN PACIFIC.—The construction of a new outside yard with drill track, storage facilities, engine house, small machine shop and blacksmith shop, is being contemplated at Lafayette, La.

SOUTHERN RAILWAY.—A power house and 27-stall enginehouse are to be erected at Spencer, N. C.

TEXAS & PACIFIC.—Contracts have been let for a new 36-stall enginehouse and other buildings at Marshall, Tex., the cost of which will be about $110,000.

SUPPLY TRADE NOTES

The Pressed Steel Car Company, Pittsburgh, Pa., has removed its office from St. Louis, Mo., to the Old Colony building, Chicago.

The Baldwin Locomotive Works, Philadelphia, Pa., is negotiating for some land near Chicago for the erection of a western plant.

W. J. Bixby, who has been appointed receiver of the Wabash, has resigned his position as a director of the American Car & Foundry Company, New York.

H. M. Percy, for several years mechanical engineer of the Joliet Railway Supply Company, Joliet, Ill., is now in the sales department of the Chicago Car Door Company, Chicago.

William H. Connell, Jr., mechanical engineer, has been made manager of the new office of Hilles & Jones Company, Wilmington, Del., in the Henry W. Oliver building, Pittsburgh, Pa.

The McKeen Motor Car Company, Omaha, Neb., has recently shipped two 70-ft., 200-h. p. gasolene motor cars to the Victorian Railways, Melbourne, Australia. The cars are adapted to a 5-ft. 3-in. gage.

Joseph F. Gettrust, for 16 years mechanical inspector of the Galena-Signal Oil Company, Franklin, Pa., has been made southern railway representative of the Ashton Valve Company, Boston, Mass., with office in Chicago.

The Biddle Hardware Company, Philadelphia, Pa., has opened a branch office at 150 Chambers street, New York. This office will be devoted to railway appliances, including the Burrows' ball-bearing jack. W. R. Burrows is manager.

J. Will Johnson, sales agent of the Pyle National Electric Headlight Company, Chicago, will be appointed general manager January 1, in charge of the sales department, with supervision of the traveling representatives. Crawford P. McGinnis, air brake inspector, Minneapolis, St. Paul & Sault Ste. Marie, and Robert L. Kilker, brother of general superintendent John E. Kilker, were appointed representatives. Mr. Johnson was born in Charleston, S. C., September 10, 1869. He started in January, 1886, in the freight department of the St. Louis & San Francisco, Pierce City, Mo., and was brakeman for one and a half years and fireman for two and a half years. In June, 1890, he was made locomotive engineer on the St. Louis & San Francisco, at Springfield, Mo. September 1, 1902, he entered the mechanical department of the Pyle company. In February, 1904, he was appointed special representative, and in September, 1908, he was appointed sales agent.

J. Will Johnson.

The Jerome Metallic Packing Company, Chicago, has moved its main offices to the Railway Exchange. William H. Dickinson, for 14 years connected with the Griffin Wheel Company, Chicago, has taken charge of the sales department. The company has secured the sole rights of manufacture and sale of the Stickley pneumatic track sander, and will also handle the product of the Ruby Manufacturing Company, Jackson, Mich.

C. B. Flint, manager of the supply department of Manning, Maxwell & Moore, New York, has resigned to become president of Flint & Chester, Inc., 237 Lafayette street, New York. This firm was formed to carry on business in railway, machinists' and contractors' supplies.

The Baldwin Locomotive Works, Philadelphia, Pa., has recently acquired the right to build the Garrett type locomotives for service in the United States and Canada. The special feature of these locomotives is that they are of high capacity and will operate on lines having sharp curves.

W. E. Sharp, general superintendent of shops for the Armour Car Lines, Chicago, has resigned to become vice-president and general manager of the Grip Nut Company, Chicago. Mr. Sharp began railway work in April, 1890, as a laborer in the car shops of the Erie at Huntington, Ind. He advanced rapidly through the locomotive and car department until 1898, when he resigned as division foreman of the locomotive and car department to become assistant shop superintendent for the Armour Car Lines. In 1900 he was promoted to shop superintendent, and later to general superintendent of shops. He will retain his connection with the Armour Car Lines as consulting engineer.

L. R. Pomeroy, until recently chief engineer of the railway and industrial division of J. G. White & Company, New York, has opened an office as a consulting engineer at 50 Church street, New York. He has long enjoyed the reputation of being an authority on railway shop equipment, operation, and construction, and is prepared to design railway shops and industrial plants, to analyze machine tool operation with reference to electric and effective operation, to advise as to the rehabilitation of shops, and to make reports and appraisals of railway and manufacturing properties. Mr. Pomeroy was born at Port Byron, N. Y., in 1857, and attended the high school at Milwaukee, Wis., and the Irving Institute at Tarrytown. From 1874 to 1880 he was engaged in commercial business, bookkeeping, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company of New York. For four years following this, he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company, jointly; this assignment involved metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1899 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads, railway shops, and the general application of electricity for all railway purposes. Following this he was for two years assistant to the president of the Safety Car Heating and Lighting Company, during which period he devoted a portion of his time to consulting work in the special field of railway shops, and machine tool operation.

L. R. Pomeroy.

CATALOGS

EXPANDERS.—Gustav Wiedeke & Company, Dayton, Ohio, have published an illustrated booklet on their expanders for locomotive boilers.

LOCOMOTIVES.—Record of recent construction No. 71 from the Baldwin Locomotive Works, Philadelphia, Pa., is devoted to industrial and contractors' locomotives.

AIR HOSE.—Guilford S. Wood, Chicago, has issued an original mailing folder illustrating the elasticity of the rubber used in Honesthose for pneumatic and air hoist hose.

LAMPS FOR TRAIN LIGHTING.—The recent improvements in the tungsten lamp, making it much more serviceable for passenger car lighting, are discussed in bulletin No. 4897 of the General Electric Company, Schenectady, N. Y.

VALVES.—The Nelson Valve Company, Philadelphia, Pa., has published a small folder on Nelson blow-off valves. These valves are made of iron for working pressures up to 300 lbs., and of steel for extreme service.

JOURNAL BOXES.—The Locomotive Equipment Company, Detroit, Mich., has a catalog devoted to an illustrated description of the Newcomb journal box. Records that have been made in fast passenger service with this design are included.

STAYBOLTS.—The Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, has issued a small folder called Boiler Construction Repairs Inspection, giving seven reasons why hollow staybolts should be used in the construction and repair of boilers.

PLANERS.—Discussion of detailed construction with illustrations occupies a considerable portion of the new catalog on the Rockford planer being issued by Joseph T. Ryerson & Son, Chicago. Specifications of four sizes, 24 in. to 36 in., are also included.

MANGANESE STEEL GEARS.—The Taylor Iron & Steel Company, High Bridge, N. J., has issued bulletin 100-B illustrating and describing Tisco manganese steel gears and pinions and bulletin 113 illustrating and describing the company's manganese steel chains and sprockets.

COUPLERS.—The National Malleable Castings Company, Cleveland, Ohio, has published catalog No. 2 on Sharon Tower, Climax, Latrobe and Chicago couplers and repair parts for freight, passenger, engine and tender service. Excellent diagrams are given of each type of couplers, and also of each repair part.

CONDENSERS.—The Wheeler Condenser & Engineering Company, Carteret, N. J., has published bulletin No. 107 on high vacuum jet condensers. Special attention is devoted to the Wheeler rectangular jet condenser, which is constructed on the counter-current principle. Wheeler barometric ejector condensers and Wheeler direct-acting jet condensers are also illustrated and described.

FIREPROOF PRODUCTS.—The Dahlstrom Metallic Door Company, Jamestown, N. Y., has published in pamphlet form the address on Reduction of Fire Waste, by Edward F. Croker, ex-fire chief of the New York fire department, at the International Municipal Congress and Exposition, held in Chicago, September 29, 1911. The pamphlet closes with a brief description of the fireproof qualities of the Dahlstrom products.

SHOT HEATING.—An interesting treatise containing practical suggestions on this subject by F. R. Still has been sent out by the American Blower Company, Detroit, Mich.

COMPRESSORS.—Bulletin 34 A 34 C and 34 E, from the Chicago Pneumatic Tool Company, Chicago, was devoted respectively to class G steam driven compressors, tandem gasolene compressors, and railroad type duplex steam driven compressors.